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WHAT SHOULD GO INTO THE PARITY PRICE FORMULA?*

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AGRICULTURAL economists generally have condemned parity prices because they do not represent present and prospective supply and demand conditions,[1] but instead project the conditions of the past into an ever-changing present and (under the Agricultural Act of 1949) future.[2] This leads agricultural economists to charge that parity prices result in misallocation of resources, market surpluses and shortages, and other undesirable economic situations.

In making this charge, we may have been appraising parity prices in too narrow a frame of reference. In a broader view, parity prices are not intended to represent present and prospective conditions of supply and demand. They are in fact designed to do quite a different thing.

This point can be made clear by reference to the milk price formulas that are now in general use in the United States.

Milk Price Formulas Include "Movers"

These milk price formulas were developed because open-market prices were not doing the job (of calling forth adequate supplies of milk and moving them into consumption). Open-market prices were not doing the job, because they really were not open-market prices in the first place. The market was open only on one side—the producer side. The buyer side of the market was oligopsonistic.

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* Journal Paper No. J-2272 of the Iowa Agricultural Experiment Station, Project 1013. I am indebted to Fred Waugh for comments.

[1] This condemnation has often been expressed by Schultz, Black, Jesness, Nourse, and others including myself.

[2] Sec. 406. p. 5. "The Secretary shall, insofar as practicable, announce the level of price support for field crops in advance of the planting season and for other agricultural commodities in advance of the beginning of the marketing year or season (January 1 in the case of commodities not marketed on a marketing year or season basis)." The Secretary has been acting under this section. He announced, for example, the "national average price support of not less than $2.21 a bushel for 1953-crop wheat" on September 9, 1952. The announcement for 1953-crop flaxseed was made on the same day.

Two remedies were considered. One was to break the few large oligopolistic buyers (milk distributors) into a large number of small competing units, so as to make the market freely competitive on both sides. The other was to build up the monopolistic power of the numerous small competitive sellers (milk producers) into a monopoly, to bargain on equal terms with the dealer oligopsony. Because the economies of scale in milk distribution are considerable, the second remedy was the one that was adopted.

For a number of years, the two bargaining parties (the organized dealers and the organized farmers in each milk shed) were not very sure what kind of price it was that they were setting. For a brief period, under the Agricultural Adjustment Act of 1933, they thought it was a parity price. They quickly found that parity prices did not do the job either; they were not responsive enough to short-run changes in local conditions. Parity prices were soon abandoned as bases for milk prices. The two bargaining parties then began to pay more and more attention to formula prices. The formulas, however, merely provided the form. What kind of prices were the formulas designed to establish?

If we look at the factors that were included in the formulas, the answer is clear. The formulas were designed to establish short-run open-market prices, the kind of prices that would exist if the market for milk in each milkshed were an open market. The purpose of the formula in each milkshed was to call forth the supply of milk that would just move into consumption at those prices. The factors in the formulas were the prices of alternative milk products—condensery milk, butter and cheese—plus an allowance for the extra cost of meeting fluid-milk sanitation requirements. In the main, these are the factors that would have determined milk prices in the open market if there had been an open market.

The factors in the formula were called "movers"—that is, price movers. As these alternative milk-product prices in the formula varied (moved) from month to month in their open markets, they automatically caused corresponding variations (movements) in the price of fluid milk. They kept that price moving in line with short-time changes in supply and demand so that it would not be necessary to call a hearing and change the price every time short-run conditions changed.

During the 1940's, when changes in demand in the Boston and New York milksheds were found to be more important than changes in alternative market prices, factors representing those changes in demand were used in the formula along with supply factors to bring the price of milk more nearly in line with open-market conditions in that area. These factors too were "movers," designed to keep the price of milk moving in line with short-time changes in supply and demand.

These milk price formulas in the major cities over the United States

made progress in remedying the main defects of the previous methods of price-determination for milk. They established, or made progress toward establishing, the same sort of prices that would have existed if there had been an open market for milk.

In some cases, the level of prices established by formula may have run a little higher than open-market prices, because of the restrictions upon the entry of producers into the milkshed that went along with the formulas. But any raising effect resulted primarily from the restrictive practices, not from the formulas. The formulas alone could not have kept prices high. In any case, the main objective of the formula was to keep milk prices automatically flexible, changing in line with rapidly changing conditions of supply and demand; and they achieved a substantial measure of success in attaining this objective.

Parity Prices Are Different

The purpose of parity prices for the major crops and products is different from the purpose of formula prices for milk. The purpose of parity prices is not to attain open market prices for corn, wheat, etc., varying with every change in supply and demand. The markets for those products are reasonably open already. The purpose of parity prices is conceived by most farmers to be to raise prices above open-market levels. They maintain that monopoly conditions exist in the rest of the economy, and that farmers therefore should develop monopoly powers themselves and set their prices higher than open-market levels.

Some economists agree with this as a matter of principle,[3] but almost all of them point out that monopoly powers cannot be attained simply by raising prices without any more control over production than agriculture has been able to develop, as a matter of practice. As a practical matter, the attainable purpose of parity prices is not to reflect but to smooth out the effects of short-time and temporary variations in supply and demand, so as to leave only the slow, long-time and more permanent variations that reflect the basic underlying factors such as population growth, technological progress in and outside of agriculture, the development of new market outlets, and so forth, unobscured by the short-time, temporary variations due to weather, insects, and other ephemeral forces.

The reasons for smoothing out the short-time, temporary variations are two: (1) The resulting fluctuating prices are erratic guides to producers. This leads to some misallocation of production resources. And (2) they create uncertainty in producers' minds, which leads to less production. This necessarily results in less consumption by consumers. It also results in less peace of mind and satisfaction to producers.

[3] Particularly J. K. Galbraith in his *American Capitalism: The Concept of Countervailing Power.*

Economists, with the national welfare in mind, can accept parity prices with this purpose, because parity prices as thus conceived increase national welfare. Parity prices which approach long-run open market prices (not short-run, variable open market prices) maximize national welfare and are in line with the national interest. They retain the allocative guidance provided by long-run open-market price levels but remove the confusion caused by short-run variations about those levels.

The Content of the Parity Formula

The attainable purpose of parity prices, then, is not to reflect short-time, temporary variations in supply and demand, but to smooth them out, so that only the effects of the long-run, more permanent changes remain.

In the light of this purpose or objective, what should go into the parity price formula?

If the purpose of parity prices were to reflect present and prospective short-time market conditions, then a dozen or more factors (mostly short-run factors, some of them forecasted) should be included in the parity formula. The formula then would be similar to a milk price formula. This parity formula would be less subject to the criticisms which agricultural economists have leveled against the present parity formula, which includes only one factor—the prices paid by farmers. The formula then, however, would be subject to a different criticism—that if it did accurately reflect short-time, temporary variations in subject and demand, it would establish parity prices that would be no different from open-market prices.

If the purpose of parity prices is to smooth out temporary variations in prices about long-run levels, then the factors in the parity formula should reflect, not short-run or temporary price-determining factors, but only long-run or permanent factors. The factors in the formula should not be short-run "movers," but long-run stabilizers or shock-absorbers against short-run variations.

What should these long-run factors in the parity formula be?

The Parity Index Stabilizes Prices Against Variations in Demand

The most undesirable short-run variations in prices are those that result from short-time variations in general demand. Farmers want protection chiefly against such drastic overall declines in general demand as took place after 1929 and began to take place again in 1948. And consumers want protection against the inflationary forces that were so strong during and after World War II.

How well does the present parity formula, based entirely on the base year price and a single factor, the parity index (the index of prices paid by farmers) serve as a price stabilization factor against short-time variations in general demand?

The parity index does not stabilize prices against short-time variations in general demand at all completely. About 30 per cent (by statistical weight) of the items in the parity index—the index of the prices of things that farmers buy—consists of things such as food, feed, seeds, etc., that farmers sell. Thus if the prices of farm products decline 10 per cent, that alone tends to pull down the parity index—the index of prices farmers

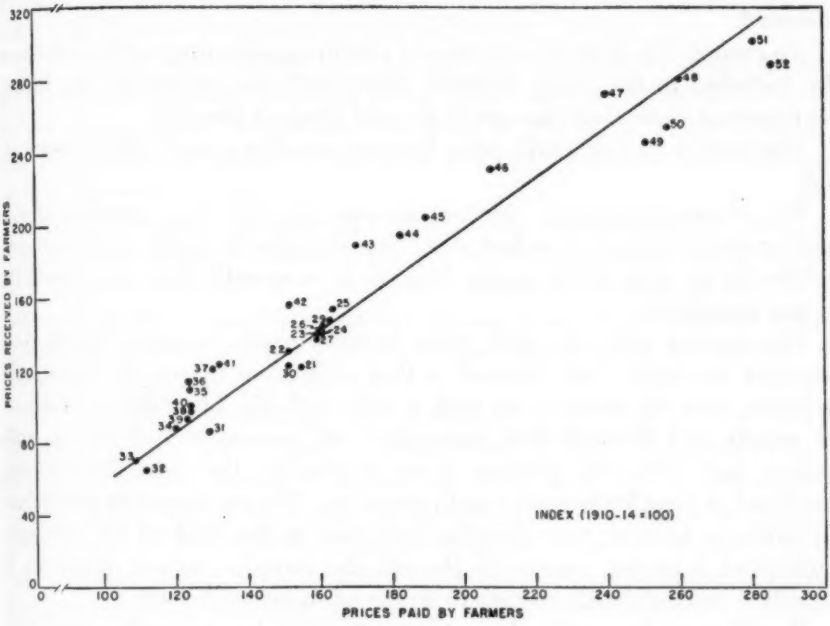

FIGURE 1

pay—by 3 per cent. So on that score alone, parity prices provide only 70 per cent stabilization.

The flexibility that exists in the other items (the non-farm items) reduces the extent of the stabilization still further. Figure 1 shows that the actual variations in the parity index are about 0.7 as great as the variations in the prices received by farmers.[4] That is, if the prices of farm products decline 10 per cent, parity prices (based on the parity index) decline 7 per cent. Thus parity prices are only 30 per cent less variable, with respect to short-time variations in general demand, then open-market prices.

[4] In the most recent years, the stabilization operations of the CCC had some effect in reducing the variations in the prices received by farmers. But these stabilization operations applied to only a few of the crops produced in the United States, and were only partially effective there, so the effects on the overall picture were not great. The relation between prices received and prices paid shown in Figure 1 is about the same after 1933, when the CCC was created, as it was before 1933.

A Term to Reflect Changes in General Demand

This degree of stability is enough to stabilize the purchasing power of farm products, but it is too much to keep farm products moving through from producer to consumer. Parity prices are too stable for that purpose. They create surpluses during depressions and shortages during booms. Many agricultural economists regard this as a shortcoming of the present parity formula—that it does not adequately reflect changes in general demand.

To correct this shortcoming, should a term representing national income be included in the parity formula, along with the present parity index, to represent short-time changes in general demand directly?

The answer is: For a milk price formula, yes. For a parity price formula, no.

The reasons for these different answers are that the purpose of the milk price formula is to reflect short-time changes in supply and demand, while the purpose of the parity formula is to smooth them out, partially if not completely.

The reasons why the milk price formula needs to reflect short-time changes in supply and demand is that milk is an extremely perishable product, and the demand for milk is very inelastic. Short-time variations in supply and demand have immediate and pronounced effects on milk prices, and since the product is so perishable, the price-determining mechanism must be sensitive and responsive. The cumbersome procedure of calling a hearing and changing the price in the light of the evidence submitted is far too slow to do the job; the formula method, however, is sensitive and automatic enough to do the job reasonably well.

If milk were less perishable, and the demand less inelastic, some form of parity price to reduce the effects of the short-time variations might be possible. But under present conditions, rather sensitive formulas work best.

In contrast, parity prices, the purpose of which is to reduce the effects of short-time variations, work reasonably well with durable crops like cotton, wheat, corn, etc., particularly with reference to short-time year-to-year variations in supply. They work reasonably well because they replace the short-time open-market price variations, that otherwise would continuously clear the market, by short-time CCC storage operations. The CCC replaces the short-time variations in *prices* by short-time variations in the *demand* for storage purposes.

Thus parity prices, backed up by storage operations, keep prices stable by varying the total demand in line with variations in supply. They clear the market, not by varying prices but by varying the demand—by putting more product into storage when supplies are large and taking it out when they are small. This works reasonably well so long as

the length of the storage period is not greater than the "shelf life" of the product.

Parity prices, backed up by storage operations, work less well with respect to variations in general demand. The reason for this is that the variations in demand, from depression to boom and back again, last longer and are more unpredictable than the year-to-year variations in supply, and in some cases exceed the "shelf life" of the product so that it begins to go out of condition before the storage period is over.

If a term to reflect short-time changes in demand were added to the parity formula, that would make parity prices more variable—that is, less stable. Parity prices then would rise more in periods of rising demand, and fall farther in periods of declining demand. Surpluses and shortages then would be less acute.

But this greater variability in prices would conflict with the purpose of parity prices. Short-time variability is what farmers want to get away from. And it would not be good for the country as a whole. It would fall short of stabilizing purchasing power against short-time variations in demand, and distract farmers' attention from the long-run movements of prices that should guide production.

On the score of stabilizing farm purchasing power, the present parity formula does the job without any term that directly reflects short-time changes in general demand. The case for such a term, if any, must rest on other grounds. One of these other grounds may be economic work-ability. Parity prices do fall short on this practical score. Even the relatively mild and brief decline in demand during 1948 and 1949 began to put a severe strain on the parity price-support mechanism. A term in the parity formula to reflect this decline in demand would have helped make the formula more workable (though less effective in stabilizing purchasing power). Instead, the "sliding scales" were devised and put into the Agricultural Acts of 1948 and 1949, to reduce the percentages of parity at which prices would be supported (not parity itself) if supplies accumulated.

These "sliding scales" are more appropriate than putting a term to reflect changes in general demand into the parity formula, since they change the level of price supports away from equivalence with costs only if storage stocks accumulate and practical necessity compels a reduction in the level of price supports. And they can be set separately for each product, according to the elasticity of demand, perishability, and other features of the product.

Need to Reflect Long-Run Changes in Demand

The term to reflect changes in general demand that is needed in the parity formula is a term to represent long-run changes in general demand. A term of this sort would be based on some such factors as total popula-

tion in the United States, the long-run trend of income per capita, and so forth.

A term to represent population growth

If agricultural production in the United States were constant, and population were rising, then (neglecting exports and imports of farm products, which run about 3 per cent and 5 per cent respectively) long-run equilibrium prices would rise. Parity prices would need to rise correspondingly.

This rise in parity prices could be attained by including in the parity formula a term to represent population growth. The elasticity of the demand for food is estimated to be −0.4 by W. W. Cochrane,[5] and −0.25 by E. J. Working.[6] The elasticity of the demand for farm products (including textiles as well as food) probably is higher than the elasticity for food only. If the elasticity were say, −0.3, then the growth in population would need to be multiplied by a factor of 3.3 (the reciprocal of 0.3) in order to keep parity prices in line with long-run equilibrium prices.

If agricultural production in the United States were not constant, its influence could be brought into the formula by using an index of agricultural production as the denominator, and the index of population growth (multiplied by 3.3) as the numerator.

All this, however, neglects imports and exports. In actual fact, if population rose appreciably in relation to agricultural production, prices would rise and that would reduce exports and increase imports. The rise in market-prices then would be substantially less than the formula would call for. The factor of 3.3 might have to be reduced, perhaps to 1, perhaps to less than 1, according to the ease with which exports would be reduced and imports increased.

Fortunately for us, we do not have to try to determine what this multiplying factor should be. Population in the United States has been rising between 1 and 2 per cent per year. Purely by accident, this is about the same rate at which agricultural production in the United States has been rising. The long-run rise in demand due to population growth has proceeded at about the same rate as the long-run rise in agricultural production. The numerator and the denominator have been about equal, so that they have cancelled out. Parity prices, therefore, by accident rather than by design, have remained close to long-run equilibrium levels.

While the accidental similarity of the two rates of increase (in agricultural production and total population growth in the United States) con-

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[5] W. W. Cochrane, "Farm Price Gyrations—An Aggregative Hypothesis," *This Journal*, XXIX: 2, May 1947, pp. 383-408.

[6] E. J. Working, "Appraising the Demand for American Agricultural Output During Rearmament," *This Journal*, XXIV: 2, May 1952, p. 221.

tinues, parity prices as a group will continue to run at approximately the same level as the long-run equilibrium (open-market) level, without requiring the inclusion of a term to represent the growth of population in the United States.

A term to represent per capita income

A question whether the parity formula should include a term to represent the long-run trend of per capita income in the United States is of a similar character, although it arises in a different context.

The General Motors wage parity formula in 1947 included an automatic increase of 2 per cent per year to reflect the rise in production per worker that was expected to take place in the rest of the economy. The General Motors managment, in effect, bet that they could keep production per worker rising at least as much as it would rise in the rest of the economy.

Now parity prices in agriculture are like piece rates, like wage rates per piece produced rather than per hour or day. It so happens that production per worker has been increasing at almost as rapid a rate (about 2 per cent per year) in agriculture as in industry since 1910, and at a more rapid rate than in industry since 1935-39.[7] Accordingly, income per worker in agriculture has increased at about the same rate as in industry.[8] Parity prices (prices with the same purchasing power per unit, such as bushel, bale, etc., as in 1910-14) therefore, again by accident, have provided approximately current parity income (income per worker in agriculture bearing about the same relation to income per worker in industry now as in 1910-14).

If General Motors can keep production per worker in its plants rising at the same rate as production per worker rises in the rest of the economy, it can pay the wages required by the formula. If not, it can't.[9] The same thing is true in agriculture. If farmers can keep production per worker in agriculture rising at the same rate as production per worker in the rest of

[7] Agricultural Outlook Charts, 1950, USDA, October 1949, p. 20.

John W. Kendrick, in an unpublished paper presented at a conference on Research in Income and Wealth, May 1951, and referred to in *Productivity, Gauge of Economic Performance,* Economic Policy Series No. 53, Sept. '52, National Association of Manufacturers, pp. 22-25, concludes that production per man-hour increased, from 1909 to 1950, 82 per cent on farms, and 114 per cent in the rest of the (private) economy. This appears inconsistent with the USDA estimates given earlier in this footnote, which show approximately equal rates of growth. Actually, the two estimates may be consistent. The NAM estimates compare production in agriculture with production in the rest of the economy, whereas the USDA estimates compare it with production in manufacturing and mining industry. Furthermore, the NAM estimates are for production per man hour, whereas the USDA estimates are for production per man year; the number of hours worked per year in the rest of the economy has declined more than in agriculture.

[8] Agricultural Outlook Charts, 1953, USDA, October 1952, p. 13.

[9] Some interesting observations on this point are offered in the NAM pamphlet, *Op. cit.*, pp. 36–37.

the economy, parity prices in agriculture will provide current parity income per worker in agriculture with income in other lines. If not, they won't.

If production per worker in agriculture does not rise as rapidly as in industry, parity prices will not provide current parity income per worker in agriculture. Farmers then might request that a term be included in the parity formula to represent increases in production per worker in other lines, so that parity prices would provide current parity income in agriculture with income in other lines. This term could consist of a fraction consisting of an index of production per worker in other lines as the numerator, and an index of production in agriculture as the denominator.

But this term should be applied to a different kind of formula–a formula for determining parity income per worker–not to a formula for determining parity price per unit of product. Income per worker in agriculture cannot be kept in line (at parity) with income per worker in other occupations by a term in the formula for parity prices per unit of product. An attempt to do so would raise parity prices above long-run equilibrium levels and lead to the accumulation of unsaleable surpluses that would soon force a reduction in parity prices or in percentage of parity support levels, as in the case of potatoes in 1949.

Income per worker in agriculture can be kept in line with income per worker in other lines, without creating impossible situations in commodity markets, only by increasing their incomes independently of prices, by direct income payments to workers in agriculture or by increasing their production per worker so that they earn more income.

Direct income payments would solve the problem only temporarily. They are appropriate for a short-run, temporary situation, but not for a long-run situation. They retard the movement of surplus farmers off the land (and the high birth rate in agriculture creates a continuous surplus of farmers) so that earned income becomes smaller than before. Increasing production per worker in agriculture is the only workable long-run way to increase agriculture income per worker.

It was for this reason that I advised against the inclusion of a term to represent income in other lines in the Japanese parity formula, when it was proposed in 1951, because it appeared unlikely that production per worker in Japanese agriculture would increase as rapidly as in the rest of the economy.[10] Furthermore, the Japanese economy was only about

[10] This point is discussed in my report "Long-Range Price Policy for Japanese Agriculture," Ministry of Agriculture and Forestry, Tokyo, Japan, August 1, 1951, pp. 22-26. It is considered with respect to the Philippines in Dimas Maulit's "A Proposed Formula for Farm Price Determination," separate from the *Philippine Journal of Agriculture*, published by the Department of Agriculture and Natural Resources, Manila, Philippines, Volume 15, No. 2, Second Quarter, 1950.

80 per cent self-sufficient ("closed") with respect to food, so Japanese prices must reflect supply and demand conditions in other food-producing countries as well as in their own.[11] The most workable solution that I could propose was a farm management research program to show how farm income per worker could be increased by consolidation of fields, enlargement of farms, and appropriate mechanization, to permit an increase in production per worker.

After the signing of the Japanese peace treaty in 1952, events took a different turn. Japan embarked on a policy of becoming as self-sufficient as possible, especially with respect to food—driven no doubt by military considerations as well as by the difficulty of gaining access to foreign markets for her exports. In order to promote the domestic production of rise in line with this "development of food self-sufficiency program,"[12] the Japanese amended their rice price parity formula in June, 1952 to include two terms. One term is designed to "reflect the changes in purchased capital stock input per tan" (the tan is the Japanese unit of area, equal to 2.45 acres—approximately one hectare). The other term is designed to reflect the relative level of consumption in urban areas. It is computed by dividing the index of expenditures (prices × quantities) for daily necessities for home use in urban areas by the corresponding index for rural areas. This term for May, 1952 stood at 104 (base, April 1951-March, 1952).

It seems to me that this second term is as wrong in principle in a closed economy such as the Japanese are seeking to attain as it is in an open economy such as we in the United States are seeking to attain, under our slogan of "Trade, not aid." The parity prices resulting from the inclusion of the term can be maintained more easily in a closed and controlled economy than in an open economy, but for the reasons given above, the term is not appropriate, and is likely within a few years to prove unworkable as well.

Clearly, a term to reflect production per non-agricultural worker should not be included in the parity price formula in the United States. Parity prices computed according to the present formula, being piece rates, already in effect include a term to reflect production per worker in the rest of the economy, so long as production per worker in agriculture continues

[11] Even in a closed economy, a term of this sort could not well reflect increasing production per worker in the rest of the economy directly. The increase in production rather must be multiplied by the income-elasticity of the demand for food. If for example the income-elasticity of the demand for food were 0.3, a doubling of production (and income) per non-agricultural worker, with no change in total agricultural production relative to total population, would permit raising parity prices only 30 per cent, not 100 per cent.

[12] *Outline of Price Policy of Agricultural Products, Especially of Rice Price Policy*, Ministry of Agriculture and Forestry, Japanese Government, January 1953.

to increase at about the same rate as in the rest of the economy. If production per worker in agriculture does not continue to increase at as rapid a rate as in the rest of the economy, then the way to keep per capita agricultural income on a current parity with per capita income in other lines is not to increase parity prices by the inclusion of an additional term in the formula, for that would merely pile up surpluses that would shortly break the program down, but to increase production per worker in agriculture by farm management research and by programs to facilitate the movement of surplus farmers off farms and into more productive urban jobs.

The Parity Index Inaccurately Reflects Costs

The present parity index, satisfactory as it accidentally is as a reflector of long-run changes in demand, is however seriously deficient as a reflector of long-run changes in supply which are based on long-run changes in costs. It is deficient in two different respects.

The first respect in which the present parity index is deficient is that it is only an index of prices paid by farmers, not an index of costs incurred by farmers. The index of the prices of things farmers buy might stand at 100, but if farmers now buy twice as much machinery, fertilizer, etc., as they did in 1909-14, they would be paying out an amount that should be represented by 200, not 100. The index shows only the prices, not the cost (prices $\times$ quantities) of things that farmers buy.

The present price index could be converted into a cost index by a change from the present system of fixed base-year quantity weights (the Laspeyres type formula) to the Paasche type formula with current-year weights. These current-year weights, however, would not be expressed as percentages of 100 in the conventional way; if they were, and the quantity of each item doubled, the weights (and the index) would remain unchanged. Instead, the quantity weights should be expressed in original quantity terms, so that if the quantity of each item is doubled, the weights (and the index) would double. The parity index would then be an index of costs, not merely an index of prices.

Need Separate Parity Indexes for Separate Crops

A second shortcoming of the present parity index is that the index is a single index for the whole United States. It is based upon the prices of 180 goods and three services (interest, taxes, and wages). The index shows the prices of goods and services for the average farmer in the United States.

But actual farmers are not average farmers. They are cotton farmers, using cotton machinery, fertilizer, and labor; they are Corn Belt farmers,

using corn planters, pickers, etc.; they are wheat farmers, using "one-way's" and combines; they are truck farmers, ranchers, fruit growers, etc., each with his own list of goods and services purchased, differing from that of the others. The United States (average) index doesn't accurately represent any of them, any more than the United States index of prices received accurately represents the price of corn, or the price of wheat, or the price of any other single product.

What is needed, then, is not only to convert the parity index into an index of costs, but also to construct separate parity indexes of costs for each farm product. It is just as erroneous to apply a single average index of costs to each one of the different farm products, as it would be to apply the single United States average index of prices received to each one of the different farm products. We recognize the need to compute separate indexes of prices received for each farm product, and have been doing that for 25 years or more. We need equally to compute separate indexes of prices paid (actually, costs incurred) in the production of each farm product.

If this had been done earlier, we would have been spared the debacle in potatoes during the late 1940's, which cost the Federal government 224 million dollars in the handling of the price support program for the 1948 crop alone, and involved the virtual destruction of 29 per cent of the crop, followed by the abandonment of the whole potato price support program. If a parity index for potatoes, reflecting the great reductions that were taking place in the costs of producing potatoes during the 1940's, had been in effect, it would have reflected those reductions in costs, reduced the loss to manageable proportions, and saved the program. A crude step in this direction was taken in the reduction of the support levels in 1949 from 90 to 60 per cent of parity; but this was unsatisfactory, leaving the potato producers with the impression that they were not being fairly treated compared with the producers of other products who were getting 90 per cent of parity. Supports were abandoned entirely in 1951.

It seems clear that the most urgently needed change in the parity price formula now is to change the parity (price) index to a cost index, and to compute it separately for each farm product. This of course would be a fundamental change in the whole parity price program. It would require intensive and extensive technical and popular discussion, extending over a period of years.

The statistical difficulties involved in this change would be considerable, but not, I believe, insuperable. The chief difficulties would be administrative and political. Each commodity group probably would press for upward revision of its costs, so as to get an upward revision of its parity price index and parity prices. This problem is minimized in the

present program, because the same parity index applies to all products, and no one product group would be justified in trying to have the whole index revised. The problem might be handled by starting with an overall parity figure, as the British start with an overall ("global" they call it, meaning "national") income figure, and holding to that, so "that 'take' in one commodity must be offset by 'give' somewhere else."[13]

Discussions of this and other problems involved in the proposed change would have considerable educational value. It is time to re-examine the whole parity price program, and consider whether it can be moved in the direction of a parity income program along the lines suggested above.

[13] W. E. Heath, "Agricultural Price Policy in the United Kingdom," *This Journal*, XXXIII: 3, August, 1951, p. 317.

LAND REFORM AND ECONOMIC DEVELOPMENT*

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DURING recent years the terms "land reform" and "economic development" have come into common usage in the day-to-day vocabularies of millions of people. For most people, the concepts suggested by these terms are probably distinct and separate. Economists, political scientists, and other students of world affairs, however, frequently use these terms in close association with each other. In this process of association, land reform often is treated as a necessary or highly desirable condition of economic development, although it might also be viewed as a partial consequence of the development process.

The importance of the interrelationship between these two concepts warrants further scrutiny. With this purpose in mind, an effort will be made in this paper to (1) examine the general nature and importance of land reform, (2) classify the principal types of land reform that are current in the world today, and (3) analyze the general effect that these reform programs may have upon economic development.

Rise of the Land Reform Issue

Land reform is a burning issue throughout much of the world today. As an action program it is new to many areas. But the problem itself is not new. Conditions that give rise to demands for reform have existed for decades, if not centuries. Peasant discontent and precedents for reform have existed since the dawn of civilization.[1] Only the techniques of reform and the will for action are new.

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** The ideas expressed here do not necessarily represent official opinion in the U. S. Department of Agriculture.

[1] History is filled with accounts of peasant revolts and other attempts of rural people to throw off or at least lighten the yoke of slavery or serfdom. Most of these attempts at agrarian reform failed and in many cases resulted in further oppression. Minor reforms, however, were sometimes carried out. As often as not, these reforms involved changes in types of ownership control and were associated with military conquest and confiscation of the properties of the vanquished. But even in ancient times, real land reforms occasionally were suggested and carried out. The agrarian reforms promoted by the Gracchi brothers in the Roman Republic during the second century B.C., for example, were prompted by motives not unlike those expressed today.

As one examines the history of land reform, it is easy to relate the demand for this type of action to the struggle of peasants and other common people for greater economic and political freedom. Usually this struggle has involved an uphill fight. Temporary victories have at times been gained, but only during recent times has the so-called common man achieved much success in establishing himself as a first class citizen in society—and then in only a limited number of countries.

The first big land reform movement in modern times came with the French Revolution. Feudalism already had given way to less qualified forms of land tenure in England and some other areas, but it was the French Revolution that prompted the first widespread emancipation of peasants in western Europe. This demand for the advantages that come with land reform gradually spread to central and eastern Europe where it made itself felt in the reform programs that followed the popular uprisings of 1848, the Russian peasant uprisings of the period before 1861 and again in 1905–1906, and the armistice of 1918. World War I was followed by a wave of agrarian reform in all of Eastern Europe. This movement was carried to an extreme in the newly constituted Soviet Union but fell short of its goal in most other countries.

Like these earlier land reform movements, the present surge in the demand for changes in the arrangements under which land is held and used also finds its roots in political change, growing nationalism, and the desire of rural people for greater recognition and for a higher standard of life. Unlike the earlier reform movements, however, the present movement has made itself felt in Asia, and to a lesser extent in Africa and the Americas, as well as in Europe.

Nature and Importance of Land Reform

In a world filled with differing problems and ideologies, land reform has come to be a term of many meanings. To some it suggests mild reforms such as measures for improvement of landlord-tenant relations or provision of better agricultural credit facilities. To others it means the breaking-up of large land holdings with expropriation of ownership rights. Still others see it as land redistribution and as an opportunity for landless people to acquire ownership.

All of these programs fit within the broad scope of land reform. From a purely technical standpoint, almost any program that leads to a change, presumably for the better, in the manner in which land is held or used might be described as land reform. Obviously, this broad definition is not acceptable to everyone. Serious questions may be raised regarding what constitutes desirable change and whose criteria should be used in the measurement of desirability of change. These questions need not be answered here. The important point is that land reform means different

things to different groups. Its exact meaning often is associated with political goals and ideologies;[2] and whereas its meaning may seem narrow and restricted in some cases, it may be stretched to cover an exceedingly broad field of action in others.[3]

At this point, one might ask: Why all this fuss about land reform? In answering this question one must remember that throughout much of the world, and particularly in the so-called underdeveloped countries, agriculture is and traditionally has been the dominant industry. It is the leading source of production and wealth, and frequently provides the basis for the prevailing pattern of income distribution. In these areas, land generally is regarded as both the safest and most favored type of investment. Big landowners often control the bulk of the productive land.

Among the peasants mass poverty is a familiar problem and life more often than not is associated with what Professor Medici has described as "the pathological symptoms . . . of peasant farming."[4] The average peasant proprietor usually has only a small fragmented holding and his great ambition is to acquire more land. His land hunger together with that of the masses of landless workers only serves to enhance the bargaining position and the consequent advantages enjoyed by the big landowners.

Given an agricultural economy with these characteristics, land reform provides one of the more promising means to improvement. As a reform program it is almost inevitable that it should work to the immediate, although not necessarily the long term, disadvantage of vested interest groups. The frequent opposition of these groups plus the normal problems of administration may give rise to immediate confusion rather than

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[2] Some Americans, for example, refuse to classify the land reform programs carried on behind the "iron curtain" as land reform because they regard these programs as undesirable. For an illustration of this point of view see Willard L. Thorp, "Land and the Future," *Land Economics*, November 1951, p. 367.

[3] An interesting example of the broad scope that can be given to land reform is provided by the resolution of the Economic and Social Council of the United Nations on land reform in September, 1951. Following its general recommendation for land reform programs, 16 detailed recommendations were made for specific types of reform. This list covers assurance of security of tenure, opportunities for land acquisition, organization of efficient sized farm units, applications of secure and equitable tenure arrangements to reclaimed and newly developed lands, provision of agricultural credit facilities, prevention of exorbitant rentals, elimination of inequitable taxes, promotion of cooperative organizations, encouragement of diversification both within agriculture and within the national economies, establishment of rural industries, provision of factories or shops for manufacture and servicing of farm machinery, expansion and development of education, agricultural research and extension programs, and improvement of the status of agricultural wage laborers.

[4] Senator Giuseppe Medici, "Diagnosis and Pathology of Peasant Farming," *Proceedings of the Seventh International Conference of Agricultural Economists*, 1949, p. 27. The more important of these symptoms are: tiny and fragmented farm holdings, primitive and unsanitary dwellings, scant use of mechanical and animal power, high ground rents and keen competition among the peasants for the available land, and widespread malnutrition, illiteracy, selfishness, and backwardness among the peasantry.

gain. Even so, the mass appeal and the general effectiveness of land reform as a leveling device in redistributing the basis for wealth makes it a popular and potentially powerful tool.

When it is used alone, land reform may bring almost immediate benefits such as lower rents or opportunities for land ownership to large segments of the population. These benefits can be used to stimulate programs of economic development. Past experience, however, suggests that they often have little effect in promoting this goal. The land redistribution programs carried out in Roumania and some of the other eastern European countries following World War I, for example, helped to gratify the land hunger of the peasants but resulted in less rather than more agricultural production.

For the most part, the relationship between land reform and economic development has suffered from inadequate attention and the failure of land reformers to really accept economic development as one of their goals. If this type of reform is to have more than an incidental favorable effect on economic development, more emphasis must be given to the integration and joint planning of these programs. Also, it should be recognized from the start that if land reform is to be used as a tool of economic development, it must be used in conjunction with a number of other programs. Among other things these programs should stimulate local desire for economic development, and promote capital accumulation and investment, higher worker productivity and an increase in total production.

At this point, one should take care not to overemphasize the importance of land reform. Economic development can and has taken place without land reform. Notable examples of this are found in England after the enclosure movement, in pre-war Italy and Japan, and in the old Austro-Hungarian empire. Numerous measures other than land reform may be used to further the development of many partially industrialized areas. But in the pastoral economies of the more undeveloped areas, the process of development usually calls for agricultural reorganization. Outside investments, growing tourist industries, and exploitation of mineral deposits may bring a measure of lasting prosperity to some areas; but for most underdeveloped areas land reform must be regarded as a highly desirable, if not necessary, step along the path of economic development. Promising as it may appear, however, it must be emphasized that land reform offers no panacea. It can carry and give life to the seeds of economic development, but the process of development must be nurtured by many forces and factors that lie beyond the scope of land reform.

Types of Land Reform

Numerous accounts are available concerning the details and operation

of the many land reform programs current throughout the world today. The panorama provided by these reports is both wide and varied. Some of the programs involve single reforms while others use a multi-point approach. Some involve mild adjustments; others are far more sweeping in their effect.

One of the more meaningful criteria for classification of these programs involves the extent of their exercise of public controls over individual action. With this approach land reform measures may be graded as in the following four-fold classification: (1) mild reforms involving some regulations and public assistance, but limited controls; (2) programs involving stronger controls, but controls short of land expropriation; (3) land expropriation from some owners for redistribution purposes; and (4) collectivization and nationalization programs carried out under governmental pressure.

Mild Reforms

Most of the so-called mild reforms that affect the manner in which land is held and used fall into one or another of the following sub-groups: (a) laws governing landlord-tenant relations and leasing arrangements; (b) land settlement and development programs; (c) measures for the provision of agricultural credit facilities; and (d) authority for voluntary land consolidation commissions.

Several countries have made considerable use of the mild reform approach and in doing so have prevented their land problems from becoming serious. Their tenure improvement programs have involved some "muddling through," and the measures they have used have never been as spectacular as land expropriation and redistribution. In countries where considerable progress already has been made in liberalizing the land tenure system a mild reform program carried out with an air of watchful vigilance may be somewhat more effective over the long-run than sporadic radical reforms. Mild reforms, however, may have but limited value if they are offered as a palliative when the need is for a more thorough reform program. A somewhat rigorous or radical start often is needed under these circumstances. But from this point on, a willingness to accept and advance a stream of mild reforms may prevent a building up of pressures that may lead to future revolutionary outbursts and demands for new radical reform programs.

Public Controls Short of Expropriation

A number of countries have exercised somewhat stronger public controls over individual action in the field of land tenure than those classified here as mild reforms. Most important among these controls are those dealing with rent control or rent reduction and those dealing with manda-

tory land consolidation. Also important are measures to prevent parcellation and to limit the extent of land ownership.

In the field of rent control a few countries such as France, Italy and the Netherlands have established agricultural rent controls and in some cases have specified legal rental rates for certain sharing arrangements. An even stronger application of public authority has been exercised in several Asiatic countries in recent years to effect sizeable rent reductions. For example, the reform program started in Szechuan Province in South China before the communist takover in 1949 called for a 25 per cent reduction in rents plus return of tenant deposits. This program has been continued in Taiwan where rental rates are now limited to 37.5 per cent of the crop. Other examples of sizeable farm rent reductions secured under force of law are found in Japan and Pakistan.

Much could be written of the evils of land parcellation and of the economic problems associated with the culture of small and scattered fragmented holdings. Yet despite the fact that authority was granted years ago in many European countries for voluntary land consolidation proceedings, peasant proprietors usually have been reluctant to act along this line. In recent years a few countries, such as France, have established more forceful programs that make consolidation preceedings mandatory once one or a few operators request action. As a part of the consolidation procedure, rural areas surrounding the villages are often replanned and roads and canals as well as field boundaries are relocated.

While consolidation provides one answer to the problem of excessive fragmentation of farm holdings, need often exists for measures to prevent further parcellation. A variety of approaches have been used to this end. Laws of primogeniture and other comparable inheritance practices that favor a single heir have been used in some areas. In Czechoslovakia, Denmark, the Netherlands, and Switzerland restrictions have been set up which specify minimum farm areas below which further subdivision cannot take place. Still another approach is used in the new state of Israel where five-sixths of the farm land is held under national ownership and is operated under a 49-year lease system that definitely limits the tenant's right to subdivide or sublease his holding or to sell his use right.

Important among the other controls over land are various limitations on area and type of ownership. Most of the countries with land expropriation programs have ceilings on the land area that individuals may own without danger of expropriation. The 200 feddan limit in Egypt, the 50 hectare constitutional guarantee in Czechoslovakia, and the 7.5 acre limit for owner-cultivators in much of Japan might be cited as examples. Similar limitations involving particular types of farm land ownership such as corporation ownership apply in the Scandinavian countries and even in some of the United States.

Land Expropriation Programs

A considerable number of land expropriation and redistribution programs have been carried out since World War I. The usual pattern has involved the use of public action to divest some landowners of all or part of their holdings. In most cases some compensation has been paid to the expropriated owners.[5] However, in some instances particularly in those areas now within the Soviet bloc, expropriation usually has meant outright confiscation and at times has been accompanied by acts of physical violence.

Land expropriation normally is followed by a redistribution of the acquired farm land among tenants, landless workers, and small peasant proprietors. Forests and other non-farm holdings frequently are retained in public ownership and in some cases estate holdings with large sets of farm buildings are retained as a unit and are designated for educational, experimental, or cooperative use.

As one might expect, a wide variety of allotment and purchase arrangements has been used. Ordinarily the individual allotments are small and in almost every case the new owner is expected to make some payment for his land. These payment schedules range from nominal payments equivalent to one or two times the annual value of the crop (as in post-World War II Czechoslovakia) to the current market value of the land. Almost invariably long-term credit and repayment arrangements are worked out to accommodate the new owners.

Collectivization Programs

In so far as exercise of public controls over individual action is concerned, farm collectivization programs such as those carried out in the Soviet Union represent an extreme type of land reform. Little space needs be given here to a discussion of the kolkhozi system. Suffice it to say that despite its theoretical voluntary and cooperative nature, collectivization in the U.S.S.R. came about and is maintained largely as a direct result of strong governmental pressure and coercion. In spite of earlier assurances to the contrary, collectivization movements now appear to be underway in Red China and in the Soviet vassal states of Eastern Europe.

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[5] A wide variety of compensation schemes are now in use. Many countries, such as Finland, have paid their expropriated owners in bonds based on current or recent land values. Egypt bases its compensation on pre-war land values. The expropriated landlords in Mexico received long term bonds for 110 per cent of the assessed value of their land. The present Italian program calls for compensation based on the tax assessed value of the land two years prior to expropriation. In India and Pakistan payments to expropriated owners are graduated according to the income-producing value of the expropriated areas. In the United Provinces, for example, large zamindars receive a nominal compensation equal to as little as twice the value of their net rents. Zamindars with small holdings, however, may receive payments equivalent to twenty times the annual value of their net rents.

Impact on Economic Development

The impact that land reform has on economic development varies considerably according to the nature of the land reform program, the manner in which it is carried out, the resources of the country and the extent to which they have already been developed, and the social, economic, political, and legal institutions of the country. In a sense, the greatest contribution that land reform can make in some countries lies in its ability to improve the institutional setting within which economic development is expected.

One of the strategic issues in the relationship between land reform and economic development necessarily rests on the emphasis given to economic development as one of the goals in land reform programs. Obviously, if the architects of land reform are concerned only with the attainment of distributive justice or some particular political objectives their programs may have only an incidental impact on economic development. In this respect it would be interesting to know how much emphasis land reformers have given in actual practice to the goal of economic development.

The problem of assessing the overall effect that land reform has on economic development is complicated by the complexity of its various ramifications. One workable approach involves separate consideration of the impact that land reform has on some of the more important aspects of economic development. Among these aspects, one might list (1) favorable political institutions, (2) social well-being, (3) population pressure against the resource base, (4) total production and efficiency of production, and (5) capital formation.

Favorable Political Institutions

One of the first requirements for economic development is a favorable climate for economic activity and socio-economic progress. Usually this requires desire on the part of both the people and the government for increased production and better levels of life. This situation has been realized to a considerable extent in the more developed countries, particularly in those with democratic institutions. In the less developed areas, economic development probably has been discouraged in some cases by the indifferent attitude of peasants and workers. More often, however, it has been blocked by the inertia and sometimes the outright opposition of the ruling class and by their reluctance to disturb the status quo. Leading examples of this may be found in semi-feudal states where the governments are dominated by landlord interests and in some of the colonial economies that are governed from afar, largely in the interests of absentee investors.

In addition to a popular attitude of willingness or desire for change,

economic development requires institutions that favor the development of individual initiative and business enterprise. This calls for education, capital, and frequently for the relaxation of restrictive measures. Public help and subsidies to private operators may facilitate the creation of new enterprises and the improvement of existing industries. In many cases the process of economic development might also be speeded by public ownership and development of certain resources and industries.

So far as private economic developments are concerned, the risk factor is always important. In this respect the political and economic institutions should offer reasonable security of expectations to the investor. No country can expect much private investment in new enterprises if its political institutions foster economic instability or fail to protect property and contract rights.

Throughout many underdeveloped areas, a strong desire exists for better living conditions and for a larger share in the benefits of modern civilization. In rural areas this desire often centers in agitation or hope for land reform. Land reform may help to quiet this demand. In and of itself, however, this action cannot provide the favorable environment needed for economic development. Land reform reflects willingness to change and to modify existing institutional arrangements. In this sense it may represent a step in the direction of economic development, but other steps must also be taken before real development is realized.

Throughout much of the western world the land reform process has involved a series of mild reforms over time. This type of land reform has been generally associated with and perhaps is conducive to a political climate favorable to economic development. Questions might well be raised, however, concerning the ability of sweeping land reform programs to achieve comparable conditions. The land expropriation process, for example, tends to shake the very foundations of the sanctity of property concept. Where expropriation takes place without full compensation to the landowner, it may wipe out part of the private investment potential of the country and at the same time discourage private investors from embarking on desirable types of economic development. In time much of this shaken confidence may be restored, particularly if a favorable political environment for economic development is created. Over the long-run it also appears that the possible favorable effects of a wide distribution of land ownership rights on the development of individual and group initiative and enterprise may far outbalance the ill effects of expropriation.

Much stock often is placed on the fact that land reform may lead to the creation of more democratic institutions. Great possibilities exist in this field because in many areas land reform can wipe away the vestiges of feudalism and pave the way for a new society. To the extent that this action breaks the power of the landlord class and permits the rise of

democratic institutions, it may make the government a better sounding board for popular feeling and it may permit wider operation of the free enterprise system. In so far as these goals are achieved land reform may foster public leadership and a greater sense of public responsibility among the common people. It may inspire more initiative on their part and encourage them to raise themselves by "tugging at their own bootstraps."

While the potentialities are great, one must remember that the road followed by the chain-reaction that starts with land reform is filled with numerous pitfalls and dead-ends. One of the more serious problems concerns the future of the democratic institutions that might be transplanted to these areas. Democracy may have a much rougher time in countries with inadequate land resources and with a tradition of servitude than in the United States or Switzerland. Desirable as the overall goal of democracy and wider participation in the affairs of government might be, one might wonder how long institutions favorable to economic development will persist if the hoped-for development does not take place. In many cases perpetuation of the democratic and other favorable institutions now being created will depend upon careful planning, integration and execution of the programs for economic development.

Social Well-being

A major aim of land reform in most countries is improvement of the lot of the peasant. Land redistribution may partly satisfy his land hunger. But the aim goes further and really calls for higher peasant incomes and opportunities for the enjoyment of higher standards of life. Rent reduction, higher incomes through increased production, and assurances of security of tenure may work wonderous improvements in peasant life. Reforms of this type permit additional productivity and income and thus enable operators to raise their standards above the subsistence level. The additional income whether spent for supplies and production equipment or for consumption items may help to stimulate industrial production and economic development. The higher standards also may generate a cycle that spreads to demand for better markets, improved educational facilities, more research and extension, greater use of cooperatives, and other similar measures.

Land reform can promote economic development in this manner. But again the process is not an automatic one. For land reform to bring these results it must provide increased production, higher family incomes, and units of economic size. Even when the reforms result in increased income and production and in peasant contentment and well-being, a certain amount of promotion may be needed to direct peasant desires and expenditures in the direction of economic development. Without this direc-

tion the benefits may easily be hoarded or dissipated with little net gain to the economy.

A problem of social well-being that should loom large in considerations of land reform and economic development centers in the choice between short-term and long-term goals. Land reform provides a means to the early enhancement of peasant well-being. But does it necessarily provide the best means for improving social well-being over the long-run? Land redistribution may help the mass of farm workers now but soon lose many of its advantages as some operators subdivide, sell, or lose their lands, while others increase their holdings. Without a follow-up program land redistribution might only succeed in starting a cycle that leads to future need for another land redistribution. This situation may be obviated, however, by a vigilant application of mild reforms over time.

Another aspect of this problem stems from the fact that programs to improve the immediate well-being of the peasant may work at cross purposes with longer range programs for economic development. For most areas, economic development entails increased industrial and commercial activity with the movement of much of the rural population into industrial and other non-farm employment. Insofar as land reform makes the peasant more content with his lot, it may add to his reluctance to leave the land. Over the long-run this could discourage industrial development and at the same time add to the already serious problem of high population pressure in rural areas. On the other hand, insofar as reform leads to higher individual and family incomes it may promote greater population mobility and more response to alternative opportunities.

Population Pressure

Population pressure and the probable prospect that any benefits that result from land reform or technological improvements may lead to further population increase is one of the hard realities that must be faced. The problem is a real one, and the answer is far from simple. Certainly land reform is no answer to the population problem. But as Irene Taeuber has observed:[6]

> None the less, the two [problems] are intimately related as continuing cause and effect. Land reforms taken in disregard of the population situation may involve no solutions to that problem but only a continuing race to move slowly or to stay in the same place. Land reform taken in full realization of the problems of population growth and as part of a comprehensive national attack on the problem may act as a powerful catalyst to stimulate the altered

[6] Irene Taeuber, "The Population of Southeast Asia," *Proceedings of the Conference on World Land Tenure Problems,* University of Wisconsin, Madison, Oct. 8–Nov. 20, 1951, Part I.

cultural values and the changing individual motivations that lead to family limitation.

This last suggestion provides a realistic approach to the problem of high population pressure. If land reform and the use of technology can bring a better life to rural people in areas of high population pressure, perhaps they can be used in conjunction with other programs to reorient the attitudes and cultural outlook of the people regarding family limitation and optimum family size.

Unfortunately, this is not an easy problem and its eventual solution may take considerable time. Over the long-run one might look with some hope to the example of France where peasant families have accepted the idea of family limitation. For most areas at the present time, however, a more hopeful approach calls for widespread education, emphasis on techniques that lead to higher productivity, and rapid development of industrialization programs to accommodate the surplus population.

Total Production and Efficiency of Production

Land reform in and of itself provides no guarantee of increased production or increased efficiency. Reclamation projects, provisions for more adequate credit facilities, and the assurance of greater security of tenure usually lead to higher production. Similarly, the reconsolidation of fragmented holdings makes more efficient farming operations possible. Land redistribution, on the other hand, may have an opposite effect. This is particularly true if redistribution involves the breaking up of operatorship as well as ownership units and if the expropriated owners have provided their tenants and workers with supervision, capital and equipment, and marketing services.[7] Under these circumstances, farm production usually declines during the first years that follow redistribution; and if no arrangements are made to provide the peasant proprietors with the managerial know-how and capital and equipment they need, total production may remain lower than it was before redistribution.

Production incentives also are important. Unless the new owner after land redistribution has to pay as much for taxes and debt services as he formerly paid to the landowner, he will usually find that he no longer has to work as hard for the same return to himself. This means that new incentives may be needed to get him to maintain or increase his production. Otherwise, he may feel content to relax and maintain his old standard of life with less work. This problem seldom becomes serious so long as the farmer finds that he can exchange his surplus production for desired goods and services. However, in areas such as the Soviet Union

[7] See "Land Reform and Agricultural Production," Report of Working Group No. 17, *Proceedings of the Conference on World Land Tenure Problems*, Part III.

during the 1920s where peasants had little opportunity to buy desired manufactured products, they often have been reluctant to produce much above their subsistence needs.

In most land reform countries labor is cheap while land is the scarce factor of production. From a national standpoint, efficiency in production usually is measured in terms of return per unit of land rather than in production per man. In the economic development of these areas emphasis must be placed upon means for increasing both individual productivity and the productivity of land. One of the best means for the attainment of this end in agriculture calls for providing each farm operator with a unit of economic size and with the capital and training he needs to operate it. Unfortunately, this approach is often disregarded for the simple reason that there are far more people claiming land than there is land to go around. Too often land reform leaves the peasants with units of less than economic size or with units that permit subsistence but little margin for improvement. These units provide a poor base for the effective use of credit and for economic development in agriculture. But even so, the peasants are still reluctant to leave their land. The long-run improvement of agriculture and the social welfare in these areas might well involve measures that will either attract or move the surplus farm population to urban areas where it can provide the nucleus for an industrial labor force. As a more practical alternative, programs should be developed that will extend opportunities for industrial employment into rural areas.

Capital Formation

Probably the greatest contribution of land reform to economic development is found in its possible impact on capital formation and investment. Where higher individual incomes and other material benefits do arise from land reform, they may go into investments in additional supplies and equipment or consumption goods, or they may be hoarded or dissipated. From the standpoint of economic development it is important that all benefits possible be used to build up the economy and stimulate further production.

Land reform can make the problem of capital accumulation and investment more, rather than less, difficult. When most of the profits of agriculture go to a few great families, it might be easier to induce these families to invest their returns in agriculture or industry than to try to persuade thousands of peasants to put their small margins of surplus to productive use. Some landlords in underdeveloped areas have used their surplus capital to stimulate local industries and commerce. Many of them, however, prefer to use their funds to further bid up the price of land or to purchase foreign luxuries. Once these individuals are deprived of farm

ownership or find the opportunity to buy farm land closed to them, they often become the potential leaders of new industries. A good example of the shift of landlord interest from rural to urban investment is provided in Mexico. As Flores has observed:[8]

> When the land reform was initiated [in Mexico] there was a flight of capital in search of security from agriculture to the cities. At first, most of this capital was invested in speculative ventures in urban real estate but soon it was attracted to the construction industry and from there it gradually spread to other industrial branches. Thus a few years after land reform had diverted capital away from agriculture, the assistance of this capital was secured and utilized through the establishment of industries new to the country.

For many landowners land expropriation means considerable loss of income if not partial impoverishment. As a consequence they lose much of their value as potential investors in new economic developments. South Korea has given some attention to the use of compensation arrangements to encourage expropriated owners to invest in industrial properties. Italy uses somewhat comparable arrangements to encourage investments in agricultural improvements. More attention should be given to means such as these for better use of this potential pool of investment capital.

Before leaving the subject of capital formation, it should again be emphasized that agriculture is the principal source of wealth in many if not most underdeveloped areas. Unless outside funds are available, the initial cost of economic development must in most cases be borne by agriculture. This situation presents a real challenge. In many areas the peasants have lived on a near subsistence basis for centuries. Their rate of capital accumulation has barely exceeded zero. Now they are asked to start out with a minimum of working capital and accumulate the fund of capital needed for the development of both the agricultural and non-agricultural sectors of the local economies. Since substantial capital grants are not available, only slow progress can be expected at first. As capital is acquired and put to use some acceleration of this process may follow. The speed with which the process will get underway depends largely upon the willingness of the populace to produce and to accept low living standards while they invest their surplus in production rather than consumer goods. If the decision on this choice is left to individual peasants much less progress in the direction of economic development may be expected than if the choice is dictated by firm public policy.

The Soviet Union provides an excellent example of a country where the price of economic development has involved high taxes, forced collections, and the continuation of relatively low living standards for the peasant population. The communists may be severely criticized for bestowing

[8] Edmundo Flores, "Agrarian Reform and Economic Development." *Proceedings of the Conference on World Land Tenure Problems*, Part I.

upon the peasants the unappreciated honor of financing the industrialization of the U.S.S.R. But had they followed a more lenient policy, the industrial development of the country probably would have suffered. While the Soviet policies need not be condoned, this example does suggest that taxation of all or part of the economic surplus realized by the peasants as a result of land redistribution, rent reduction, or other land reform programs does provide a potential source of funds for financing economic developments. It would probably be neither wise nor fair to tax away all the benefits of land reform nor to continue these taxes for several years. But if agriculture must bear the initial costs of economic development, this would appear to provide a quicker means for getting programs under way than waiting for peasant proprietors to accumulate capital and branch out into industrial and other non-agricultural pursuits.

Land Reform: A Catalyst for Development

In conclusion, emphasis might well be placed on the point that land reform by itself provides no guarantee of economic development. This does not mean that land reform is unimportant. In many areas it appears as a highly desirable step in the path of economic development. But it must be used carefully or it may only complicate the problem of development. Even under ideal circumstances it must be recognized that land reform cannot do the job alone. Other programs must be used in conjunction with land reform. The process of economic development involves the interplay of numerous factors, many of which play a more strategic role in the usual process of development than does land reform. But be this as it may, land reform in many cases can make a considerable contribution. In the workings of the world a well developed land reform program often can act as the catalyst that sets in motion the whole stream of economic, social and political changes that go with economic development.

CHINA'S ROAD TO COLLECTIVIZATION

A. Doak Barnett*

THE Chinese Communists have started on the long, hard road to agricultural collectivization, even though their current land redistribution program is not scheduled for completion until this Spring.

The agrarian reform policies followed by the Chinese Communists to attract peasant support during their struggle for power, and to consolidate power since 1949, have been based upon redistribution of land and "liquidation of the landlords as a class." But it is now clear that this program is merely a first step, preliminary to collectivization.

The general outline of the process of collectivization in China took shape in 1952. It calls for a transitional period, lasting several years, in which peasants will be organized first into mutual-aid teams and then into agricultural producers' cooperatives, in preparation for ultimate collectivization of a more complete sort. At the same time, state farms, machine tractor stations, centers supplying improved tools, and experimental collective farms are to be organized to point the way toward the final goal.

It is obvious that the Chinese Communists in their plans for collectivization are following the road already travelled by the Soviet Union, but it also appears that they are capitalizing on Soviet experience in an attempt to avoid some of the pitfalls previously encountered by the Russians.

Agrarian Reform—First Step

On June 30 of last year, on the second anniversary of the promulgation of the 1950 Agrarian Reform Law, Peking announced that "agrarian reform has been completed in the overwhelmingly great part of China." More specifically it was claimed that except for areas inhabited by racial minorities (where implementation of the program is postponed), agrarian reform has been wholly completed in Northeast China, Inner Mongolia, and North China, 85 per cent completed (in terms of total farm population) in Northwest China, 90 per cent completed in East China, and 81 per cent completed in both the Central-South and Southwest regions of China. With the exception of minority areas, the remaining districts—Sinkiang Province and parts of Tsinghai, Kansu, Yunnan, Kweichow, Kwangtung, and Kwangsi—are scheduled to have completed agrarian reform by the spring of 1953. Chinese Communist claims on the progress

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of land redistribution may be an exaggeration, since reports in mainland publications indicate that they are encountering serious problems in carrying out agrarian reform in South China, and that the struggle continues in many areas. But it does appear to be true that by the spring of 1953 the 1950 Agrarian Reform Law will at least have been applied to all major regions of the country.

The general situation in those areas where the existing agrarian reform law has been thoroughly implemented might be described briefly as follows. A segment of the rural population classified by the Communists or their revolutionary People's Tribunals as "counter-revolutionaries," "bandits," and "despots" has been physically liquidated. The landlords, who under the old regime usually were the community leaders, have been "liquidated as a class," their land and most of their capital has been confiscated and distributed to landless and poor peasants. In the process of class warfare against the landlords, the middle, poor and landless peasants have been organized into peasant associations under Communist control, and the activists among them have emerged to join with Communist Party members and leaders of Communist-organized mass organizations of various sorts to form a new rural elite and bureaucracy. The landlords' holdings, distributed by the peasant associations, have become the private property of the persons to whom they were distributed.

Although the amount of land held by so-called middle peasants has been the standard for general equilization of land ownership, there are still, however, variations in the acreage owned by peasants. This is due partly to the fact that, according to current Chinese Communist policy, the "rich peasant economy" is temporarily preserved. Rich peasants are allowed to retain the land which they cultivate, either alone or with hired hands, and many are permitted to keep ownership of some land which they rent out. But, although they are generally the most efficient producers in any region, rich peasants are not given official encouragement; on the contrary, they are supposed to be politically "neutralized." The temporary policy of tolerating them is dictated by the Communists' desire to keep up agricultural production as much as possible while carrying out their rural revolution.

The essence of the Chinese Communists' agrarian reform, therefore, has been confiscation of landlords' holdings (small portions are allotted to the landlords themselves if they can cultivate it) and redistribution of the land to small, individual, peasant proprietors. Until recently this has been regarded by a great many people in China, including the poor and landless peasants who have received the land, as the final aim of Communist policy. The Chinese Communists formerly did not attempt to disabuse people of this misconception. Although there have been in the past a few direct and many oblique references to future collectivization,

the Chinese Communists have played down the fact that land redistribution is merely a tactical stage on the road to collectivization. Now, however, when completion of agrarian reform is in sight, individual peasant proprietorship, which constituted the declared aim of agrarian reform, is already being labelled "backward."

Stages of Collectivization

At the end of 1951, Wu Chueh-nung, Chinese Communist Vice-Minister of Agriculture, defined three separate stages in the development of Chinese agriculture under Communist rule: (1) the initial step of agrarian reform, (2) the reorganization of agricultural production through mutual-aid teams and agricultural producers' cooperatives, and (3) "collectivization of agriculture on a nationwide scale on the pattern of collective farming in the Soviet Union." The Chinese Communists are now completing the first step and are embarking upon the second. The task for 1952 was briefly outlined in an editorial on January 1 of last year in the official Peking *People's Daily*: "In the sphere of agriculture," it said, "we should organize peasants into organizations of mutual-aid, producers' cooperatives, and supply and marketing cooperatives in a more planned manner."

There are a number of theoretical and ideological factors which impel the Chinese Communists to push forward toward collectivization as rapidly as possible. In discussing agricultural problems, they frequently quote Lenin's statement that, "Small-scale production gives birth to capitalism and the bourgeoisie constantly, daily, hourly, with elemental force, and in vast proportions." Individual peasants, with their "petty bourgeois" mentality, are considered to be a constant potential threat to socialism, and collectivization is a method of "proletarianizing" the peasantry. In surveys of selected areas where agrarian reform was completed some time ago, Chinese Communists have noted, with alarm, a resurgence of capitalist features such as usury and renting of land, and a strengthening of the "rich peasant economy" with a trend toward reconcentration of land. This undoubtedly gives considerable urgency, in their minds, to the need for preliminary steps toward collectivization.

Furthermore, the Chinese Communists' general economic program calls for industrialization of the country, and this requires an agricultural economy which can produce a surplus. They firmly believe that large-scale collective methods, with or without mechanization, will increase agricultural production. An article in the Peking *People's Daily* in the summer of 1952 stated, for example: "Chairman Mao has pointed out that land reform is a revolution, and organization is a revolution. Both of these revolutions can bolster the productive forces and augment production." Developments in the Soviet Union cast doubt on the proposition that large-scale collective enterprise in agriculture, even if accompanied

by mechanization, necessarily results in increased production, but this does not seem to shake the Chinese Communists' faith that it will.

There are other more practical justifications from the Communists' point of view for rapidly introducing collective forms of agricultural organization. The experience of the Soviet Union indicates that collectives provide effective means for imposing government controls on the rural population and for guaranteeing delivery to the state of the grain required for an enlarged bureaucracy and the agricultural raw materials required for state-controlled industry. It is possible to achieve these objectives through organization regardless of whether or not collectivization leads to increased production—or even if it results in lowered production.

The transitional period leading to collectivization in China may be a long one, however. Peasant resistance can be anticipated from the start, and it may become violent as the process develops. But the Chinese Communists "benefiting from Soviet experience," are apparently planning a relatively gradual process, to minimize the opposition which could be expected from abrupt, radical changes.

In 1949, Mao Tse-tung in *On People's Democratic Dictatorship* wrote: "The education of the peasantry presents a serious problem. The peasant economy is dispersed. According to the Soviet Union's experience, it takes a long time and much painstaking work before agriculture can be socialized." More recently, Kao Kang, top Chinese Communist leader in Manchuria, said that the correct policy for China is one of "gradually leading the peasants toward collectivization through examples set by state farms and agricultural production cooperatives."

Planned Dialectical Process

This emphasis on the need for a planned, orderly process leading step-by-step toward collectivization contrasts with what took place in the Soviet Union where, after several sudden advances and retreats, collectivization finally took place during a frenzied four-year period (1928–1932) in which perhaps 5 million kulaks were dispossessed and the mass of peasants were forced into collectives.

The Chinese Communist approach seems to be more calculated, with every stage preparing the way for, and minimizing possible opposition to, the next one, in a sort of dialectical process. This applies even to the first stage of land redistribution carried out in the agrarian reform now being completed; despite the violence and passion involved in land redistribution the Chinese Communists seem to keep the process under control to a large degree.

In agrarian reform the first step is liquidation of armed opposition. Next comes mass organization and indoctrination, then (in most areas) rent reduction and repayment of peasants' deposits by the landlords. This

is followed by careful preparation for the climax: land classification, class demarcation, and then elimination of any possibility of resistance from the landlords and other opponents of the program. Finally redistribution of the land is carried out.

With very little time lag, steps toward collectivization are now being started. Peasants are first organized into mutual-aid teams. Later these are converted into agricultural producers' cooperatives. Finally, collective farms are organized. It is this step-by-step process which is distinctive about Chinese plans. The goals, including collective farms, state farms, machine tractor stations (or equivalent centers for mechanical improvements of a more simple nature), etc. are adapted from Soviet models, but the process of achieving them, as revealed in Chinese plans, involves a more gradual succession of stages.

In August of 1952, the Peking Ministry of Agriculture issued a statement claiming that 35 million peasant families, representing 40 per cent of all peasant families in the country, had already been organized and belonged to one of the 6 million mutual-aid teams and 3,000 agricultural producers' cooperatives said to be operating in China. This claim may be high, but there is no doubt that strong pressures, intensive "education," and the preferential treatment given to organized peasants are effectively supporting the accelerated drive to get peasants into the first simple forms of collective production units.

Furthermore, the 60 per cent of the peasants who had not yet (in 1952) joined any sort of collective production units are not exempted from organization. Except for the rich peasants—who are excluded from almost all organizations—most others belong to peasant associations which, under Communist Party leadership, exercise a considerable degree of control over their members. No overall statistics on peasant association membership are available, but figures for specific regions indicate that virtually all those classified as middle peasants or lower belong to the associations. For example, in 1952 individual membership in Central-South China was claimed to be 40 million and in Southwest China over 33 million, giving a total of 73 million for two of China's six major regions.

In addition, a high percentage of China's peasants now belong to rural supply and marketing cooperatives which regulate sales of agricultural produce and purchases of industrial and consumer goods. Although in theory these cooperatives are a special element in the economy, distinct from both state enterprise and private enterprise, they are in fact government-run and controlled. Increasingly, they are dominating the markets for agricultural goods and indirectly, therefore, they exert a strong influence on production. Official figures in 1952 revealed that cooperatives in China then had 106 million members, and most of these were members of rural supply and marketing cooperatives.

Mutual Aid Teams

As already stated, the first step in the organization of collective production units is the establishment of mutual-aid teams, and these are now being rapidly organized all over China.

There are many gradations and variations of mutual-aid teams. In their simplest form they consist of a small group of families—usually less than half a dozen—who agree to help each other by working jointly and using each other's tools and animals. This type of mutual-aid has historical precedents in China, where it occasionally developed among the poorest peasants particularly in times of natural calamity. Simple teams of this sort are usually temporary and seasonal and disband after accomplishment of the specific tasks which they were organized to perform. In the pre-Communist period, mutual-aid of this sort was informal and spontaneous, but the Chinese Communists are now putting it on an organized basis.

One of the first moves required to regularize and develop more highly-organized mutual-aid teams is to convert them into permanent, year-round units. Such teams require a systematized division of labor, and during slack seasons the team members can work together in collective tasks other than cultivation, such as subsidiary, non-agricultural production. Once this stage has been reached, organized management is required. The Chinese Communists last year stated that 20 per cent of the 6 million mutual-aid teams already established were permanent, non-seasonal units of this sort.

One of the characteristics of simple mutual-aid teams, as contrasted with more developed forms of collective agricultural organization, is the fact that in them the peasants not only retain title to their land but also receive, as private income, the produce from their own plot of land. The Chinese Communists admit that this is the cause of many conflicts and frictions between the members of such a team. Every member is primarily interested in his own land, and therefore wants the team as a whole to work his portion of the land in the best way and under most favorable conditions. Every member, for example, wants his land to be plowed early, to be sown at the best possible time, and to be harvested after maximum ripening but as soon as possible after heavy winds (which cause crop losses). He also wants the team to work long hours on his land and shorter hours elsewhere. Needless to say every other team member feels the same way.

The Chinese Communists seem to believe, however, that these conflicts within the mutual-aid teams help to prepare the way for "higher forms" of organization, and facilitate adoption of a system of further division of labor and distribution of produce on a more centralized basis. There are several types of organization which they still refer to as mutual-aid teams,

but which are actually transitional forms already possessing some of the characteristics of agricultural producers' cooperatives. When several of these teams are merged into larger units, it is relatively easy to convert them into producers' cooperatives.

One large "model mutual-aid team" in North Anhwei Province is described in Chinese Communist publications as follows: A total of 22 families, including 136 villagers, make up the team. Under the direction of a 9-man central committee, 89 full-time workers and 12 half-time workers, who are divided into 3 agricultural production groups, cultivate about 73 acres of land. They share use of the 20 oxen and donkeys, 5 carts, and 27 plows owned by members. Three families, however, are detached from agricultural work, and spend their time on subsidiary enterprises, including the making of vegetable oils, malt, sugar, and bean curd. Because of this division of labor, there is a need for dividing the joint produce on some basis other than every man taking the produce of his own land. The work of both men and animals is classified, therefore, and distribution is made on the basis of "equal pay for equal work."

Membership in mutual-aid teams is "voluntary," but the Chinese Communists have evolved effective means of applying pressure to force "voluntary" action. Initiative is taken by party members and village political workers. They enlist the assistance of peasant activists (particularly those who have encountered production difficulties) and model peasants and start organizing a few families; from then on the process relies on a snowball effect. Once it is under way it is given added impetus by provincial and *hsien* model workers' conferences, mutual-aid teams' representatives conferences, and training classes for chiefs of mutual-aid teams.

The Communists claim that the mutual-aid teams increase production by overcoming shortages of tools and animals, result in more efficient use of labor, make possible collective efforts to improve irrigation and combat pests, and facilitate organization of surplus farm labor for secondary production. There is some logic to all of these claims, but whether or not the goals are achieved depends on many factors which are difficult to evaluate, such as methods of team management, rates of agricultural taxation, and other factors which affect peasant attitudes and incentives.

The value of the teams from the state's point of view is unquestionable, however. For example, they play a leading role in the "patriotic production increase emulation" drives by which efforts are made to stimulate harder work. The government is now attempting to obtain production pledges from peasants in the form of "patriotic compacts," and organized units are much more convenient to deal with than individual peasants. Over 1 million of the 6 million existing mutual-aid teams were said to have taken part as organized units in such production drives last year.

State Trading

Another way in which the teams are invaluable from the government's point of view is that they facilitate collection of agricultural products by state agencies. If official claims are to be accepted, the Chinese Communists have made surprising progress in bringing the distribution of major agricultural products under the control of monopolistic state trading companies. These companies deal to the maximum degree through rural supply and marketing cooperatives, and the latter encourage the formation of mutual-aid teams and producers' cooperatives with which they can deal. The pattern which is emerging is as follows. A state trading company which handles one special product will make a contract with supply and marketing cooperatives (often this takes place at a provincial level, and the provincial cooperative organization divides the contract among its lowest village-level subsidiaries), which then make contracts for future deliveries with organized peasant units. Frequently, state marketing companies dealing in textiles, fertilizer, farm tools, and consumer goods are brought in, and "linked" contracts or barter arrangements are made. At the village level this might mean that a mutual-aid team would agree to supply the local supply and marketing cooperative with a specified amount of rice in return for certain amounts of fertilizer and cloth. This system gives the government great control over internal trade, and because of its monopolistic nature it facilitates regulation of prices and, indirectly, determination of what will be produced.

The degree to which this system enables the government to monopolize trade in agricultural products can be illustrated by a few official figures. Last year 70 per cent of the total amount of wheat marketed in China was scheduled to be bought by the state, and in most provinces 50 per cent of state buying was done through cooperatives. All state purchases of cotton were carried out through cooperatives last year, and by July contracts with cooperatives covered 40 per cent of the year's total cotton crop. In Hunan, one of China's major grain-producing provinces, over 90 per cent of the new rice reaching the market in 1952 was purchased by the state through cooperatives, and the situation was undoubtedly similar in other provinces for which figures are unavailable. Cooperatives are referred to as the "foundation for the state to control industrial raw materials and export goods," and it might be added that mutual-aid teams and agricultural producers' cooperatives appear to be the foundation for efficient operation of supply and marketing cooperatives.

To help develop mutual-aid teams and agricultural producers' cooperatives, the government is now giving all sorts of "economic and technical help and preferential treatment" to them; this assistance gives them an advantage over their individual peasant competitors. "This year,"

according to a 1952 report, "the state has extended farming loans to the amount of more than JMP $3,000,000,000,000 (roughly US $135 million), principally to mutual-aid teams and agricultural producers' cooperatives. New farming implements, improved seeds and agricultural drugs and apparatus have also been introduced principally through mutual-aid and cooperative organizations. The state farms are gradually strengthening their technical help to mutual-aid teams and producers' cooperatives, and the state banks in some districts are beginning to sign 'credit contracts' with mutual-aid teams and producers' cooperatives. The supply and marketing cooperatives of various districts also sign 'linking contracts' with mutual-aid teams and agricultural producers' cooperatives. All this," the report ends, with a fine understatement, "plays a great part in helping the development of cooperatives and mutual-aid organizations."

Agricultural Producers' Cooperatives

The second stage on the road to collectivization after mutual-aid teams are organized is the establishment of agricultural producers' cooperatives. It appears that generally this will be done by merging several well-developed mutual-aid teams and reorganizing them into cooperatives.

A succinct definition of agricultural producers' cooperatives was given in a recent issue of a Chinese Communist periodical. "An agricultural producers' cooperative," it said, "is an economic organization of unified management and collective labor, based on private ownership of land. It is a higher form than the mutual-aid teams, which are quite common in China at the present time. It is, however, a lower form in comparison with the Socialist collective form, and is therefore a transitional form between the two. Its main characteristic is that members invest their land in the common enterprise, being credited with the corresponding number of shares. Its other features are a combination of agriculture with subsidiary occupations, a certain degree of production planning and division of labor, and a certain amount of common property—including modern agricultural implements."

One of the 3,000-odd producers' cooperatives of this type claimed to be organized in China by mid-1952 is located in Chuanti village, Shensi. It was established in the spring of 1951, 9 years after completion of land reform in the area (which was under Communist control during the war) and 8 years after the first mutual-aid team was set up. The cooperative was established by merging 2 of the 10 mutual-aid teams existing in the village in 1951. These two teams had 76 members, including 16 women, from 18 households, and they cultivated about 18 acres of land. Establishment of the cooperative, in which local Communist Party members took the lead, was claimed to be necessary because "the scattered nature of peasant holdings . . . became a more and more obvious obstacle to

economical production," because it "became necessary to find a planned way to use the manpower which the mutual-aid teams had "freed," and because the mutual-aid teams "could not accumulate enough capital."

Each member of the Chuanti cooperative, according to Communist sources, retains a small plot of land for private use, and the rest, even though theoretically still privately-owned, is collectively farmed. About 7.5 acres, out of a present total of 24 acres, are retained for private use. Cultivation of the remaining 16.5 acres is under centralized management by a committee chosen by the cooperative, and the produce, after taxes, is divided between public savings, which are re-invested into the co-operative, and private income distributed to members. It is reported that in 1951 of the net profits (i.e. after subtracting costs of production), 8 per cent was retained as public savings, 40 per cent was distributed to members as dividends on the land they invested, and 52 per cent was distributed as wages. The savings were re-invested, 60 per cent for production and 40 per cent for welfare, education, medical service, and recreation. Land dividends were distributed according to a value given each private share on the basis of its previous yield, and wages were computed on the basis of "work points," every 10 points representing a "Work day" defined as "a day's ordinary labor at average efficiency." Various types of labor were rated either more or less than 10 points, and there was a daily checking, and a tabulation every 10 days of the value of the work done by members.

Many management problems arise in running these producers' cooperatives. The consolidated assignment of labor, the planning of land use for crops, decisions on joint or individual use of tools, remuneration for the use of private tools and animals, assessment of labor, direction and leadership of work teams, accounting and finance, and similar problems must be solved. Probably the thorniest problems involve distribution of the produce. Several alternative methods are used. Sometimes land and labor are both treated as stock. In other cases, a fixed rent is paid on the land, and the remainder is distributed on the basis of work. Occasionally, distribution is based entirely on labor. The Chinese Communists show a definite preference for remuneration based to a large degree upon labor, in order to stimulate hard work, but it is difficult for them to ignore the right to remuneration for land, since the land is still theoretically private property.

The Communists claim that all sorts of advantages result from organization of producers' cooperatives, but since the claims are made to advance their program, it is difficult to evaluate them. They claim, for example, that in the cooperative at Chuanti land utilization was improved by consolidation of plots, that acreage was increased (very slightly) by destruction of boundaries, that labor productivity was increased by 22 per cent

as a result of collective effort and planning, that the entire labor of 8 persons was diverted to subsidiary occupations, that agricultural technique was improved, that collective effort made possible the purchase of better equipment and the setting aside of small plots for experiments and seed selection, that crop yields were raised by 32.7 per cent in 1951 over 1950, and that the conflicts of personal interests which had existed in the original mutual-aid teams disappeared. This is a very bright picture—so favorable that one is inclined to believe that it may represent the theory rather than facts typical of the cooperatives.

Collective Farms

The final stage in the collectivization process in China will be the transformation of agricultural producers' cooperatives into collective farms. At this stage private ownership gives way to joint ownership of the consolidated farmland.

Although collective farms are not to be widely organized for some years, according to current Chinese Communist plans, experimental models have already been set up, principally in Manchuria and Sinkiang. The "first successful collective farm in China," called "Spark," was organized in 1951 near the south bank of the Sungari River in Manchuria. The experience gained there does not have applicability to most other parts of China, since the farm was established on virgin soil, with a heavy investment of government capital and with unusual advantages such as the existence of a rare tractor station nearby, but it, and other experiments like it, are intended to serve as examples of the final goal and as the basis for propaganda in favor of collectivization. The farm did go through the step-by-step process leading from mutual-aid teams to agricultural producers' cooperative to collective farm, but the process was compressed into the relatively short period of four years.

The Chinese Communists now proclaim that this farm has "proved the possibility of organizing farming as an industry." They admit that, "the age-old desire to own land individually is so deep that for these peasants to have been able to pass beyond that stage and put as much interest into the collective as into their individual property is indeed a tremendous step forward." But they add that, "It shows that the road to larger scale and better standards of agriculture is not quite so difficult as some people might have imagined."

According to articles in Chinese Communist publications, "Spark" has 26 families cultivating about 250 acres of land. It is a full-fledged collective, in which the land and capital are jointly owned, and it is run by a control committee elected by the general farm members meeting. It has a considerably more complex management than producers' cooperatives. Its officers include a chairman, vice-chairman, and committee member

in charge of finance and food, all three of whom do not take part in agricultural production. The control committee also has under it a production section (which manages 34 men and 12 women engaged in actual farming), a horticulture section, a dairy section, a rice mill, and a work shop.

The net produce of the farm was reported to be distributed as follows, in 1951: 27.3 per cent went to the state in the form of taxation, 10 per cent was retained by the collective (in 1952 it was to be increased to 12 or 15 per cent), 6 per cent went to the state in the form of "donations and contributions," and 56 per cent was distributed to peasant members. The amount given to members was based upon a system of assessing labor by "points." Every specific job was rated, and actual crediting of points was based upon efficiency and quality of work, with occasional bonuses for "encouragement." Male labor was divided into 7 grades, ranging from 8 to 11 points, and female labor was classified into 3 grades, from 6 to 7 points. The farm is now considering adoption of a system of "fixed quotas," however, with bonuses and penalties based on actual performance as compared with the quotas.

State Farms

Collectives are the type of farming which is the main goal of Chinese Communist policies. In addition, however, the Chinese Communists are planning to develop several kinds of state agricultural enterprises modelled, as in the case of collectives, or their prototypes in the Soviet Union. "In order to set an example to the peasants and to enable the state to control some important farming products," the official Peking *People's Daily* stated on January first of last year, "we should during 1952 greatly develop state farms and strive to operate successfully state farms in every province, every administrative district, every *hsien, ch'u* (under conditions that land is available)." The larger state farms, run by the Farm Management Bureau of the Ministry of Agriculture, are to be set up on waste land and are to include from 2,500 to 10,000 acres of land, which is tremendous for China. A small percentage of the larger state farms are to be fully mechanized, while the remainder are to have improved tools and equipment.

The actual development of state farms to date probably varies in different parts of the country, but by the middle of 1952 East China was reported in Chinese Communist publications to have 718 state farms cultivating a total of about 95,000 acres. Of these, 268 were run by *ch'u* governments, 371 by *hsien* governments, and 73 by governmental organs of a higher level. Six of the 718 were classified as really "large-scale" farms, having over 10,000 mow (about 1,666 acres). Manchuria is the region where state farms are mostly widely developed, however, and of the 41 "major mechanized state farms" in China in mid-1952, there were 30 in

Manchuria, 10 in North China, 3 in East China, 1 in the Central-South, and 1 in the Northwest.

One of the larger state farms is located at Lutai in North China and has about 8,250 acres. Organized in 1949, on wasteland, by 275 cadres and workers sent by the Ministry of Agriculture, this farm now is said to have almost 1,300 workers who are experimenting with Soviet techniques, such as machine sowing of rice and close planting of cotton. It is highly mechanized and has a tractor brigade, repair shop, and smithy. The workers, who are paid flat wages, are organized into a trade union, and the farm is managed by an administration committee which provides services of various sorts to the workers. Production is regulated by a five-year plan.

State farms of this sort, whose workers "have become members of the rural proletariat of a socialist nature," are intended "to demonstrate to New China's emanicipated peasants the superiority of scientific, mechanized farming and collective labor." Their two main specific functions are to "educate the peasants" and to provide technical aid to mutual-aid teams, agricultural producers' cooperatives, and the "peasant masses."

Mechanization of agriculture is also an important aim of the Chinese Communists, even though they believe organization alone can accomplish some of their aims and realize that mechanization is a rather distant goal. "Our organization," a Peking *People's Daily* editorial during 1952 stated, "is still geared to the basis of existing production tools, or slightly improved tools, and not machinery," but the Chinese Communists are none-the-less proceeding with experiments in mechanization. . . "in every administrative region, province, and administrative district, we should establish state factories or repair shops to supply the countryside with modern farming implements," the *People's Daily* said on January 1st of last year. There has been very little publicity about such factories and shops, but undoubtedly some have been established. In addition, a few machine tractor stations, modelled after the ones which played a very important role in collectivization in the Soviet Union, have been organized. The first station of this type, with six Soviet tractors, was established in Manchuria last Spring. This station makes plowing contracts with nearby peasants and uses collective farms, agricultural producers' cooperatives, and "good" mutual-aid teams as "key points to carry out services." It also, in theory at least, "enables organizations of cooperation and mutual-aid to develop and improve," because "in using tractors, plots of land must be linked up."

Timetable of Collectivization

Although the pattern of collectivization in China has become fairly clear, the schedule which Chinese Communist leaders hope to follow is

more difficult to determine. A few indications of the planned pace of development have been given, however. The Northeast (Manchuria) can be taken as an example, although it is the most "advanced" of all regions in China and is ahead of the schedule of socialization elsewhere. The Communists claimed last year that 80 per cent of the peasants in the Northeast were organized, and that a large percentage of the mutual-aid teams there were permanent, year-round ones. The goal for agricultural producers' cooperatives in the Northeast in 1952 was one or two per *hsien* (county). Several hundred state farms had already been established, and the goal for last year was at least one in every *ch'u* (the next administrative level above the villages). And a few experimental collectives and tractor stations had been organized. A top Communist leader in the Northeast states that, "With the development of industry the rural villages will be provided with modern farming tools in 5 to 6 years, the agricultural cooperatives shall be the main form of organization for agricultural production, and collective farms and state farms will also move one step forward." He adds that, "In 5 to 6 years, it is expected that modern horse-drawn agricultural machinery will be employed in the greater part of the Northeast. . . ." The Northeast, of course is much more richly endowed and technologically advanced than any other region of China, so its timetable is undoubtedly ahead of that for the country as a whole.

The program of agricultural collectivization which the Chinese Communists propose to follow raises a number of basic problems and questions.

One of the main problems which Chinese Communist leaders will have to face eventually is how to deal with the rich peasants. Rich peasants—those who farm themselves but own more land than they can cultivate alone—are in general the most efficient agricultural producers in any region. They are also a bulwark of individual captalist agriculture and a major obstacle to collectivization. In the Soviet Union they were eliminated only after a costly and violent anti-kulak campaign.

The Chinese Communists are frank in admitting that their current policy of tolerating the rich peasants is temporary (at certain periods in the past rich peasants were liquidated along with landlords), but it appears that they hope to cope with the problem by less disruptive means than those in the Soviet Union. Present Chinese Communist policy seems to be one of isolating the rich peasants and undermining their position by discriminatory treatment. Rich peasants not only are excluded from mutual-aid teams and producers' cooperatives; they are also barred from peasant associations, which is more serious since these associations perform many governmental functions. The Chinese Communists' progressive land tax places a heavy burden on them, and they are also discriminated against in government loan and assistance policies. This may indi-

cate a policy of slowly squeezing them until they gradually are undermined and lose their economic independence—a policy which has been successfully applied to private enterprise in China's cities. In any case, one can be sure that they will eventually be "liquidated as a class," although if they are sufficiently weakened the harsh methods used against Chinese landlords may not be required.

The problem of general peasant resistance is certain to increase as the Chinese Communists' collectivization program develops, because it is not only the rich peasants who favor private ownership of land. Regardless of propaganda in favor of collectives, the Chinese peasant is likely to retain his deep-rooted desire to own his own piece of land, and it is difficult to believe that collectivization can be achieved in China except by strongly coercive measures.

The probability of strong peasant resistance even if it is confined by police-state methods to passive resistance, is one of the factors which makes the Chinese Communists' belief that collectivization will lead to increased agricultural production very much open to question. Despite certain obvious technical advantages which collectivization in theory can bring, such as consolidated use land (the fragmentation of individual holdings is a serious problem in China), the productivity of land cannot be divorced from the incentives and attitudes of those cultivating it. This has been illustrated in the Soviet Union by the wide discrepancy between the output of collective land and that of private plots retained by members of collective farms. (The latter are more productive because the peasants devote more and better care to them.) It may be even more true in China, where traditionally farming has been so intensive (with consequent high per-acre yields) that it has often been described as "gardening. Less enthusiasm could cause a considerable drop in production.

The nature of Chinese agriculture has, in fact, raised many questions in the minds of non-Marxist observers as to the applicability, even in theory, of collectivist conceptions of state-run "large-scale mechanized farming" to China. The ratio of labor to land is very high in China. Methods of cultivation are extremely intensive. Mechanization of wet farming (which prevails over much of China) is certainly very difficult, and the prospects for China producing enough farm machinery to mechanize even dry farming regions are remote. And it is difficult to foresee rapid industrialization in China, which would be necessary to absorb agricultural labor displaced by mechanization.

There is no doubt, however, that collectivization, to the extent that it can be carried out in China, will improve the government's control over the rural population and over the produce of the agricultural economy. This, in fact, is undoubtedly the main motive and justification for it. The peasant does not want it, but the state requires it to proceed with its plans for socialization.

THE NATURE OF THE RACE BETWEEN FOOD SUPPLIES AND DEMAND IN THE UNITED STATES, 1951-75*†

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I

WITH the exception of one rather brief period prior to World War I, agriculture in the United States has enjoyed prosperity only during periods of war, or war induced famine, over the past 100 years. The continuous peacetime pressure of food supplies on population needs in the United States has been ably demonstrated by John Brewster.[1] And the several historical price series for food and farm products which extend back to the 19th century all tell the same story—a story of high farm prices and war, low farm prices and peace. Thus one cannot help but wonder what the nature of farm price trends may be over the next 25 years.

We, of course, have no crystal ball which tells us whether war, peace, or something in between will be realized over the next 25 years. Hence we cannot, and do not try to predict the state of international relations, or, for that matter, the state of internal economic health for the period in question. But we can make certain assumptions regarding the nature of internal and external developments during the next quarter of a century, and, where we do, the aggregative type of analysis provides a convenient analytical method for dealing with the important forces at work in the different situations.[2] The concept of aggregate demand and supply provides a vehicle for observing and considering the forces involved in the long-run race between increasing food supplies and increasing demand, wherein the outcome of that race is measured in terms of price level movements.

Aggregate demand is related to aggregate supply for the period 1951–75 in three different, but plausible, situations. We might describe these situations through time as possible paths of development. The three paths we have in mind are:

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[1] "Farm Technological Advance and Total Population Growth," *This Journal*, August, 1945; see also his note in *This Journal*, February, 1951.

[2] The method is described and employed in *An Analysis of Farm Price Behavior*, Progress Report No. 50, The Pennsylvania State College, Agricultural Experiment Station, May, 1951.

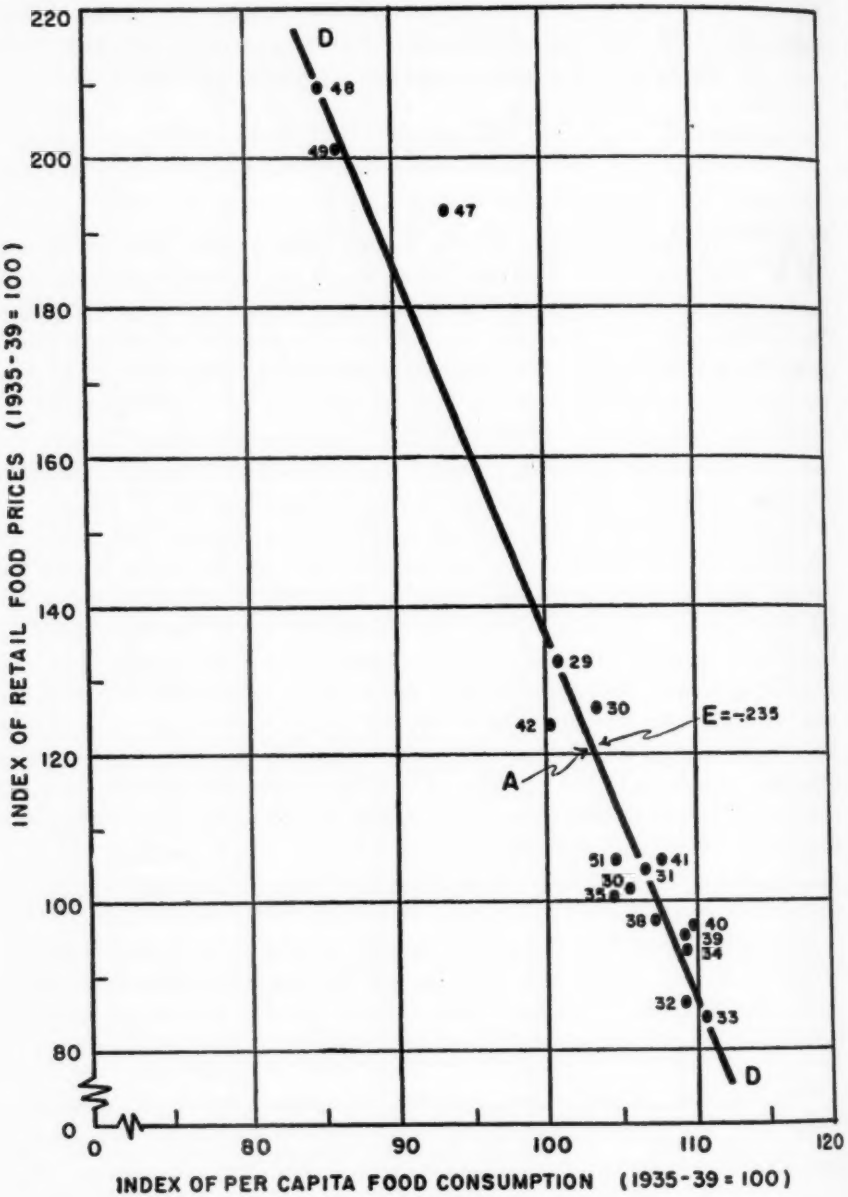

FIG. 1.—THE AGGREGATE DEMAND CURVE FOR FOOD

1. Chronic hot and cold wars over the entire period (but something less than an all out war effort);
2. Continuous peacetime prosperity from 1953 through 1975;
3. Inflation followed by deflation (The combinations of timing and magnitude are numberless here, but to illustrate this situation we assume that a sharp business depression occurs in 1965 followed by economic stagnation).

It is not our intention to predict which of these situations may obtain, but to describe in terms of equilibrium price levels, what the consequences of these situations may be for agriculture in the United States. Inasmuch as the use of slightly different rates of change in certain key forces (e.g., aggregate food output, population growth, and total disposable income) can result in substantial changes in the equilibrium price solutions, the solutions obtained should be regarded, not as precise measures of magnitude, but rather as indicators of the direction of change under the assumed conditions.

II

The concept of the aggregate demand for food which we employ is conventional in most respects; the aggregate demand curve describes the amount of food that will be demanded—taken—at each level of food prices. The specific formulation of the aggregate demand for food used throughout the statistical analysis is presented in Figure 1. The aggregate demand curve DD in Figure 1 states the relation between (1) food prices at the retail level[3] and (2) the per capita consumption of food after the net effects of income and trend have been removed.[4] The curve DD is thus a simple

[3] This is a departure from the method used by the senior author in Progress Report No. 50, *An Analysis of Farm Price Behavior*, the Pennsylvania State College, May 1951. The use of the index of retail food prices rather than the ratio of food prices to non-food prices has certain conceptual advantages, and the use of the index of food prices in this context does not appear to be less reliable.

[4] The technique for removing the net effects of income and trend from the food consumption data was suggested by the discussion of part correlation by Mordecai Ezekiel in his *Methods of Correlation Analysis* (1930 Edition) pp. 181–182. In brief, the regression coefficients from the multiple regression equation:

$$X_{1c} = 98.10069 + .21740X_2 - .18803X_3 - .02373X_4$$

(Where: X_1 is the index of per capita consumption of food; X_2 is the index of per capita disposable income; X_3 is the index of retail food prices; and X_4 is time.) provide measures of the net influence of each independent variable on the dependent variable, per capita food consumption. Specifically, the influences of X_2 and X_4 on X_1 were removed as follows: The actual value of each variable for each year was subtracted from the mean value of the variable; the differences were multiplied by the applicable regression coefficients and the sums of the two products thus obtained were substracted from or added to (as indicated by sign) the actual value of the index of consumption to yield adjusted index values of per capita food consumption. *These adjusted values were then correlated with the index of retail food prices to derive the curve DD in Figure 1* (the equation for DD is $Y = 635.41789 - 4.97508X$, where Y is the index of retail food prices and X is the adjusted index of consumption). In other words, the regression coefficients for income (X_2) and time (X_4) taken from the multiple regression

regression line associating the index of retail food prices with the adjusted index of per capita food consumption over the periods 1929–42 and 1947–49. Although the regression line does not fit the data perfectly, we conclude that the fit is sufficiently close to provide a measure of aggregate demand for the periods immediately preceding and following World War II. The price elasticity of this curve is −.235 at the point of averages (Point A, Fig. 1).[5]

It should perhaps be noted parenthetically at this point that the index of per capita food consumption is a price weighted index. That is, the influence of a unit change in the use of a high-resource using–high-priced food (e.g., beef) is greater than a unit change in a low-resource using–low-priced food (e.g., flour). Thus the index is influenced by changes in the quality of the diet as well as changes in the total quantity of food consumed.

The principal shifters of the aggregate demand for food over the long-run period 1951–75 would appear to be personal disposable income and population growth. Increases in per capita disposable income will have the effect of expanding the aggregate demand for food, whether those increases stem from increased money supplies alone, or increased money supplies and increased output of goods and services.[5a] In either case, the average family will use some part of the increased money income to *try* to improve its diet (i.e., expand food consumption by improving the quality of the diet in most cases, by increasing the quantity in some cases). In both cases the demand curve for food will be shifted to the right through the allocation of more of the money income for food. In the specific case where food supplies do not increase, efforts by individuals to improve their diets simply force prices upward.

There is a question, however, as to the extent to which continued real income increases may be expected to swell the aggregate demand for food. How long may we reasonably expect increases in real personal dis-

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equation are used to remove the influence of those variables on food consumption so that the remaining variation in food consumption may be related to the index of retail food prices.

[5] Following the suggestion of E. J. Working in his paper, "Appraising the Demand for American Agricultural Output During Rearmament," *This Journal*, May, 1952, the values used in computing the regression line DD are not those for zero values of income and time, but for the average values of those variables (See footnote 4). This method positions the DD curve through the mean values of consumption and price, and yields a lower measure of price elasticity than was obtained in Progress Report food prices.

[5a] Some critics feel that the income shifter used here should be real income. But these critics miss the purpose of this analysis, namely, to provide price solutions in terms of current market (or money) prices. For it is the change in farm market (or money) prices over time that describes the nature of the race between the demand for and supplies of food. And, market (or money) price solutions logically result from the interaction of money demand on one hand and actual supplies on the other.

posable incomes, growing out of the happy circumstances of increased money supplies and the increased output of goods and services, to act to expand the aggregate demand for food? Upper income families in the United States may be expected to demand more services with their food as their incomes continue to increase, but not more food as such. Even lower income families reduce their consumption of potatoes, cereals, beans, and fats as they increase their consumption of animal products, fresh fruits, and vegetables, with rising incomes. The time is foreseeable in the United States, perhaps by 1975, when the index of per capita food consumption may be expected to cease rising with increased real incomes.

Over the long-run, such as is under consideration here, the rate of population growth plays the role of an important, if not the most important, determinant of the aggregate demand for food. In the underprivileged areas of the world, the aggregate demand for food is a simple function of the number of mouths to be fed. In a country such as the United States where the income elasticity of food is low and becoming lower, changes in the aggregate demand for food over time are also becoming a simple function of the number of mouths to be fed. We might generalize as follows: changes in the over all demand for food are dominated in the short-run by income changes and in the long-run by the rate of population growth.

The mechanics of the analytical method employed here, however, do not call for the use of population growth as a shifter of the demand curve, since the formulation of aggregate demand presented in Figure 1 is on a per capita basis. Per capita food consumption is related to the price of food. The aggregate demand curve for food describes, at any given time, what the "average" consumer in the United States stands ready to take at varying prices. We must then relate to the demand curve, which is on a per capita basis, a supply curve which is also on a per capita basis. The adjustment for population growth in this analysis then takes place on the supply side. The quantity of food per consumer is reduced in any given year to the extent that population increases; the supply of food per capita is nothing more or less than the total supply available for civilian consumers, divided by the number of civilian consumers.

Our concept of the aggregate supply of food follows directly from the previous discussion. We assume that the quantity of food supplied the average civilian consumer does not vary with price. In terms of the Marshallian cross, the supply function is perfectly inelastic, passing through the quantity point for any year obtained by dividing the total civilian supply by the total civilian population. This assumption is somewhat unrealistic, but we make it for two reasons: (1) we were unable to derive a satisfactory statistical supply relationship involving post-World War II data; (2) pre-World War II data indicate that the supply function

for food at retail is highly inelastic.[6] Thus we use a perfectly inelastic supply function as an approximation to the highly inelastic supply function; and in terms of the operational system, output responses take the form of the supply curve shifting to the right.

The total supply of food available for civilian consumers in the United States in any year between 1953 and 1975 has several determinants:

1. The rate of aggregate output expansion;
2. The change in the volume of exports and imports;
3. Changes in the size of the armed forces of the United States.

The rate of aggregate output expansion (i.e., the total output of food products each year between 1953 and 1975) itself depends on several strands of development: (a) weather and growing conditions, (b) total inputs devoted to food production, and (c) the rate of technological advance on farms. The first element of the problem we assume away by assuming "average" weather and growing conditions over the period involved. Such an assumption appears reasonable and in fact, there would seem to be no alternative. With regard to the second element of the problem we would hazard the following guess; the total inputs devoted to the production of food will not vary importantly over the period under consideration. We would expect inputs of land to hold nearly constant with decreases in labor inputs approximately offsetting increases in capital inputs. But on one point we must be explicit for much of the reasoning that follows hinges on this point—*the transference of workers out of agriculture will not occur so rapidly that the output gains from technological advance are nullified to the extent that the rate of expansion of aggregate farm output falls below that realized between 1910 and 1951.*

The third element in the determination of the rate of aggregate output expansion is technological advance. For us it is the dominant element. Farm technological advance will give rise to continual and substantial increases in the total output of food over the next 25 years even if total inputs hold constant or decline modestly. This expectation of continued and widespread technological advance with its attendant expansion in total output rests on several firm footings: (1) basic research and technological development are going on in every phase of agricultural production and marketing—from time and motion studies on the farm to the development of improved pasture grasses, from the use of antibiotics in increasing growth rates of livestock to the Central Valley Irrigation project in California; (2) private and public agencies are spending well over $100 million each year to assure the continued outpouring of new technologies; (3) a well organized and widespread extension service stands

[6] In this regard, see Fig. 10, Progress Report No. 50, *Op. cit.*, where the supply function employed in the operational system is highly inelastic.

ready to carry these new ideas, practices, and technologies to the farm and aid in their adoption; (4) the Federal Government has and may be expected to continue to help producers finance the farm adoption of new ideas and practices, and (5) as a society we believe in technological progress—value it highly—and will continue to encourage it in agriculture. In brief, we accept the view presented by Professor John D. Black in early 1949:[7]

> The major part of the increased agricultural output of the years since 1939 appears to have been due to higher technical intensity of cultivation and new applications of technology. There was a very large backlog of technologies only sparingly used in 1940. My friends in the Agricultural Research Administration of the USDA tell me that there is a surprisingly larger backlog today than in 1940.

The development of new technologies also enhances the possibilities of transferring agricultural resources from the production of non-food items to food items and of conserving agricultural resources for food uses. The substitution of synthetic fibers for cotton is an important illustration of the former and the substitution of vegetable oils for animal fats an apt illustration of the latter. Thus, in peace-time, technological advance can turn the old pressure of population on food supplies into the pressure of food supplies on population, at least insofar as the United States is concerned.

What hapens to food imports and exports over the period under consideration will obviously affect the total supply of food available for civilian consumers. Other things being equal, increased food exports reduce supplies available for civilian distribution, and conversely. Further, we must make adjustments in the relevant aggregates for variations in the size of the armed forces. This means that total population figures must be adjusted for the size of the armed forces, or changes in the size of the armed forces, to yield civilian population. Correspondingly, supplies required to feed members of the armed forces must be deducted from the supply aggregate to yield the food aggregate available for civilian distribution.

In broad outline, then, we make the rate of aggregate output expansion a function of technological advance. Total food output in any one year is adjusted for variations in the level of imports, exports, and size of the armed forces to yield an aggregate available for distribution to civilian consumers. This aggregate is divided by total civilian population to derive the specific formulation of the aggregate supply of food employed in this analysis (i.e., a perfectly inelastic aggregate supply curve for food). The race between the aggregate demand for food and total supplies of food in

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[7] John D. Black, "Coming Readjustments in Agriculture—Domestic Phases," *This Journal*, February, 1949, pp. 7–8.

the United States between 1951 and 1975 may now be appraised in terms of the shifting action of the aggregate demand curve for food relative to the aggregate supply curve for food where each is computed on a per capita basis.

III

The economic dimensions of the alternative paths of development considered here for the United States, 1951 to 1975, are presented in Tables 1 and 2 and Footnote 11. The precise nature of the data presented in these tables suggests a concreteness or objectivity in those data which does not exist. Personal judgment was obviously involved in choosing the paths of development under discussion here. Personal judgment also enters into the measurements at another level: the relationship of one measure to another (e.g., the relation of the index of per capita disposable income to the index of industrial production) in any particular path becomes a matter of judgment at numerous points. In any event, the dimensions of the various paths are set out, and the bases of the price level solutions that follow are made known to each reader for appraisal and modification as he sees fit.

We turn first to Situation I, chronic hot and cold wars (but not an all out war effort). In general this situation represents a state of domestic and international affairs similar to that which has existed since 1947. Accepting this path of development as a reasonable alternative for consideration we need (1) to review the economic dimensions of this path, and (2) to ascertain how certain of the measures were derived.

The total population estimates presented in Table 1 for 1965 and 1975 are derived from the B.A.E. trend of medium population growth. Such would seem to be a reasonable assumption, given the present uncertainty with regard to population trends. The military estimate obviously grows out of current statements of the military with regard to manpower requirements.

Estimates of total disposable income in Table 1 are extrapolations of the trend that existed between 1934 and 1952. The rate of increase of this trend is less rapid than was the case in such periods as 1938–43 and 1949–52, but it is close to the rate of increase that did exist over the period 1942–50. Implicit in these estimates is a rapid rate of price inflation. We estimate that the level of consumer prices in this situation would increase 45 per cent above current levels over the period 1951–75, or from 185 in 1951 to 268 in 1975.

The estimates of food production in Table 1 represent, with the exception of one minor adjustment, a continuation of the trend that occurred between 1910 and 1951. The 1910–51 trend ($Y = 69.3311 + 1.5825X$) was raised to the level of the average production for the period 1947–51 with

TABLE 1. THE ECONOMIC DIMENSIONS OF SITUATION I: CHRONIC HOT AND COLD WARS, UNITED STATES, 1951–1975

Category	Units	1951*	1965	1975
Population				
Total, U. S.	(millions)	155.3	176.3	190.1
Military	(millions)	3.5	4	4
Index of civilian population	1935–39 = 100	117.7	133.6	144.3
Income				
Total Disposable Income	(billions of $)	223	362.7	468.7
Index of Per Capita Income	1935–39 = 100	281.6	403.3	483.5
Food Supplies				
Index of Production‡	1935–39 = 100	141	163.9	179.7
Imports	Constant 1935–39 dollars in millions	475†	475	475
Exports	Constant 1935–39 dollars in millions	525†	525	525
Military use	Constant 1935–39 dollars in millions	455†	520	520
Food Consumption				
Index of total civilian consumption	1935–39 = 100	132.3	152.4	168.5
Index of per capita civilian consumption	1935–39 = 100	111	114.1	116.8

* All data for 1951 are to be found in regularly published series, except those indicated by the † which are authors' estimates.
‡ Index of total production for sale and farm home consumption.

a new point of origin at the midpoint, 1949. The index of food production is thus 138.6 at the new origin (1949) and it increases 1.5825 points per year.

The data presented in Table 1, opposite the headings Imports, Exports, and Military Use are value aggregates computed in constant 1935–39 dollars at the farm level. As such these value aggregates may not be compared directly with any regularly published series (they will, however, be used to advantage later in the computation of the index of total civilian food consumption over the period 1951–75), but we get some appreciation of the relative importance of these supply adjusting factors in the following discussion.

Imports are assumed to remain approximately constant at the 1940–49 average level, or at some 6.8% of the 1935–39 average level of food production. Imports have fluctuated relatively little in the past, and the assumption of constant imports does not dangerously strain the facts. Exports during the period of intermittent wars are assumed to approximate 1948–49 average level of exports, or 5.5% of 1948–49 production. This value includes estimates of military–civilian feeding as well as commercial exports and U.S.D.A. shipments and purchases. The value used implies a continuation of present policies with respect to foreign relief feeding, not however, at the very high rates achieved in the immediate postwar years of 1946–47.

Military uses are based on the assumption of a four-million man service in 1965 and 1975 and three and one-half million in 1951. The value aggregates for military use are based on a farm value of $130 per man per year in 1935–39 dollars. It is clear that any variance in the size of the armed forces from these estimates will cause a change in the value aggregates.

The estimates of per capita food consumption of civilians presented in Table 1, and required by the operational system as a measure of supply, could have been derived from some projection of historical consumption trends; but such a method would leave unconsidered the question of future levels of production and such supply adjusting factors as imports, exports, and military uses. Observing that food production is the primary determinant of the food available for consumption in any one year, our problem becomes that of estimating the index of total civilian consumption from some measure of production after such influences as imports, exports, and military uses have been taken into account. Changes in stocks we ignore in this connection, since year to year variations in consumption due to changes in stocks should even out over a 25-year period.

The formula constructed to estimate total consumption from an adjusted total production is:[8]

$$I_c = \frac{I_p(7{,}007) + A - B}{7{,}287}$$

where:

I_c = Index of total consumption of food
I_p = Index of total production of food for sale and farm home consumption
A = Total farm value of imports in millions of 1935–39 dollars
B = Total farm value of exports and military uses, 1935–39 dollars
7,007 = Farm value aggregate of food produced, 1935–39 average in millions of dollars
7,287 = Farm value aggregate of food available for consumption in millions of dollars, 1935–39 average in millions of dollars

The index of total consumption is then divided by the index of civilian population to derive the index of per capita civilian consumption.

The values of the indices of total civilian consumption and per capita consumption presented in Table 1 were computed by the above formula, given the independently derived value estimates of imports, exports, military uses, and production also presented in Table 1. The index values

[8] The 1935–39 average farm value aggregate of food produced (7,007) was computed from Table 67, pp. 188–191 in *The Consumption of Food in the United States*, USDA, BAE, Misc. Pub. 691. The farm value aggregate (7,007) was then adjusted to reflect imports and exports and yield a measure of the value aggregate of food available for consumption (7,287) for the base period 1935–39. The data for imports and exports were obtained from Section A, Table 2, p. 6, of the same publication.

obtained by this method for per capita food consumption in 1965 and 1975 are 114.1[9] and 116.8 respectively. This is an increase of about 5% from 1951 to 1975. The 1975 estimate is slightly lower than the all time high of 118.6 reached in 1946.

The path of development, Continuous Peacetime Prosperity is conceived to be an ideal situation; the best that could be hoped for over the long-run future. This does not mean that all individuals and groups are free of problems. It simply means that the overall economy succeeds in avoiding inflation on one side and deflation on the other as *average* per capita real incomes increase steadily.

The economic dimensions of Situation II, Continuous Peacetime Prosperity, may be reviewed briefly. Two important series of estimates remain unchanged from Situation I, namely, total population and the index of food production (see Table 2). It could be argued that either one of these forces should be modified in some way. But which way?—that is the question. We have left them unchanged. The important change in Situation II over Situation I is with respect to total disposable income; the rate of increase in disposable income is much less rapid in Situation II. The assumed rate of income expansion is three billion dollars per year and is consonant with the expected rate of expansion in real goods and services given continuous prosperity. This rate is slightly less rapid than that realized from 1947 to 1952 and more rapid than the rate of increase between 1923 and 1929. Although the selection of a three billion dollar rate of increase is somewhat arbitrary, it appears to be a reasonable compromise of past and present periods of prosperity.

The price level is assumed to be constant at the 1952 level over the entire period; no price inflation is involved. This assumption is somewhat unrealistic, but the assumption of a real rate of increase in disposable in-

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[9] The index value for 1965 was obtained as follows: Given the formula $I_c = \frac{I_p(7{,}007) + A - B}{7{,}287}$ with $I_p = 163.9$, A = \$475, and B = \$1045 (Military use = \$520 + Exports = \$525). Substituting the values in the formula we obtain $I_c = \frac{163.9(7{,}007) + 475 - 1{,}045}{7{,}287} = \frac{10{,}914}{7{,}287} = 149.8$, the index of total civilian food consumption. However, upon comparing the results of estimation with the actual index of consumption for the periods 1924–1941 and 1946–49, it was found that the formula underestimated those values of the index above the mean. The estimates were correlated with the actual values and the equation (Actual Value) = −6.72095 + 1.06221 (Estimate) obtained (r = .996). The estimates obtained from the formula above were then corrected with the equation to obtain the values used in the analysis. Thus, the corrected value for 1965 = −6.72095 +1.06221 (149.8) = 152.4. The index is placed on a per capita basis by dividing the corrected total value by the index of civilian population, 133.6, and 152.4/133.6 = 114.1 the estimate of the index of per capita food consumption for 1965.

TABLE 2. THE ECONOMIC DIMENSIONS OF SITUATION II: CONTINUOUS PEACETIME PROSPERITY, UNITED STATES, 1951–1975

Category	Units	1951*	1965	1975
Population				
Total U. S.	(millions)	155.3	176.3	190.1
Military	(millions)	3.5	1	1
Index of civilian population	1935–39 = 100	117.7	135.9	146.6
Income				
Total Disposable Income	(billions of $)	223	274	304
Index of Per Capita Income	1935–39 = 100	281.6	304.7	313.5
Food Supplies				
Index of Production‡	1935–39 = 100	141	163.9	179.7
Imports	Constant 1935–39 dollars in millions	475†	475	475
Exports	Constant 1935–39 dollars in millions	525†	360	360
Military use	Constant 1935–39 dollars in millions	455†	130	130
Food Consumption				
Index of total civilian consumption	1935–39 = 100	132.3	160.5	176.6
Index of per capita civilian consumption	1935–39 = 100	111	118.1	120.5

* All data for 1951 are to be found in regularly published series, except those indicated by the † which are authors' estimates.
‡ Index of food production for sale and farm home consumption.

come has certain advantages as a bench mark in drawing real income comparisons from relative price changes.

The value aggregates for exports and military uses are down in Situation II as compared with Situation I. The direction of this change is certainly reasonable, although the exact figure as far as exports are concerned is a "guess-estimate." The net effect of these latter changes in the supply influencing factors is that of increasing the intake of food of the average civilian consumer in 1965 and 1975 over that which obtains in the Chronic War situation. In short, the estimates of per capita food consumption 118.1 and 120.5 for 1965 and 1975 respectively for Situation II are representative of high level food consumption.[10]

Situation III grows out of Situation I in this formulation. A situation of deflation and subsequent stagnation, such as is visualized here could develop out of a variety of situations for a variety of reasons. We have chosen this particular pattern to illustrate the price-income consequences of a serious business depression. It is assumed that (1) a sharp downturn in total economic activity occurs in 1965, (2) the down spiral

[10] For comparisons with numerous estimates of optimum food requirements see, "Analysis of Estimates of Food Requirements and Demand" by Marguerite Burk, *Agricultural Economics Research*, U.S.D.A., January 1951.

is stopped through government intervention before a situation comparable to 1929–33 is reached, and (3) the government places a floor under the economy and supports it through 1970 at some level below "full employment" but above the level it would seek if left alone. The economic dimensions of this government-supported level of economic activity are presented in footnote 11 for the year 1970.

The obvious difference between the year 1965 (Situation I, Table 1) and the year 1970 (Situation III, Footnote 11) is the important decline in disposable income. Total disposable income declines from $362.7 billion in 1965 to $308.3 billion in 1970, with a comparable decrease in the index of per capita disposable income. This decline in income is assumed to involve decreases in both the physical volume of goods and services produced—the reduced employment of inputs—and the general price level.

Several important consequences would seem to stem from the contraction in money income which is built into this situation. First, we presume that farm technological advance would be reduced to a trickle and total inputs in agriculture would neither decline nor increase; hence the index of food production is projected from 1965 to 1970 at the level achieved in 1965, namely, 163.9. Second, the depressed situation envisaged here would act to dampen the volume of trade between nations, hence the value aggregate of exports is reduced drastically and that of imports reduced modestly. Further, the value aggregate for military use is cut in half as is the size of the armed forces, since it is presumed that the depressed situation under description grows out of the cessation of chronic hot and cold wars.

The net effect of the above changes in the economic dimensions of the economy as it moves from inflation to deflation is that of bringing to a halt the upward trend in the per capita consumption of food. The index of per capita civilian food consumption declines slightly from 114.1 in 1965 to 113.2 in 1970.

IV

The time has come to bring together the diverse strands of this long-run analysis, and this is achieved in terms of price level solutions wherein the aggregate demand for food is related to the aggregate supply. We turn first to Situation I, Chronic Hot and Cold Wars. The conditions of supply are summated in the index of per capita food consumption and are presented in Table 1. Since we assume that the quantity supplied does not

[11] The Economic Dimensions of Situation III for the year 1970: (Units are the same as those in Tables 1 and 2) Total Population = 183.2; Armed Forces = 2; Index of Civilian Population = 140.5; Total Disposable Income = 308.3; Index of Per Capita Income = 330.0; Index of Production for Sale and Farm Home Consumption = 163.9; Imports = 400; Exports = 250; Military Use = 260; Index of Total Civilian Consumption = 159.1; Index of Per Capita Civilian Consumption = 113.2.

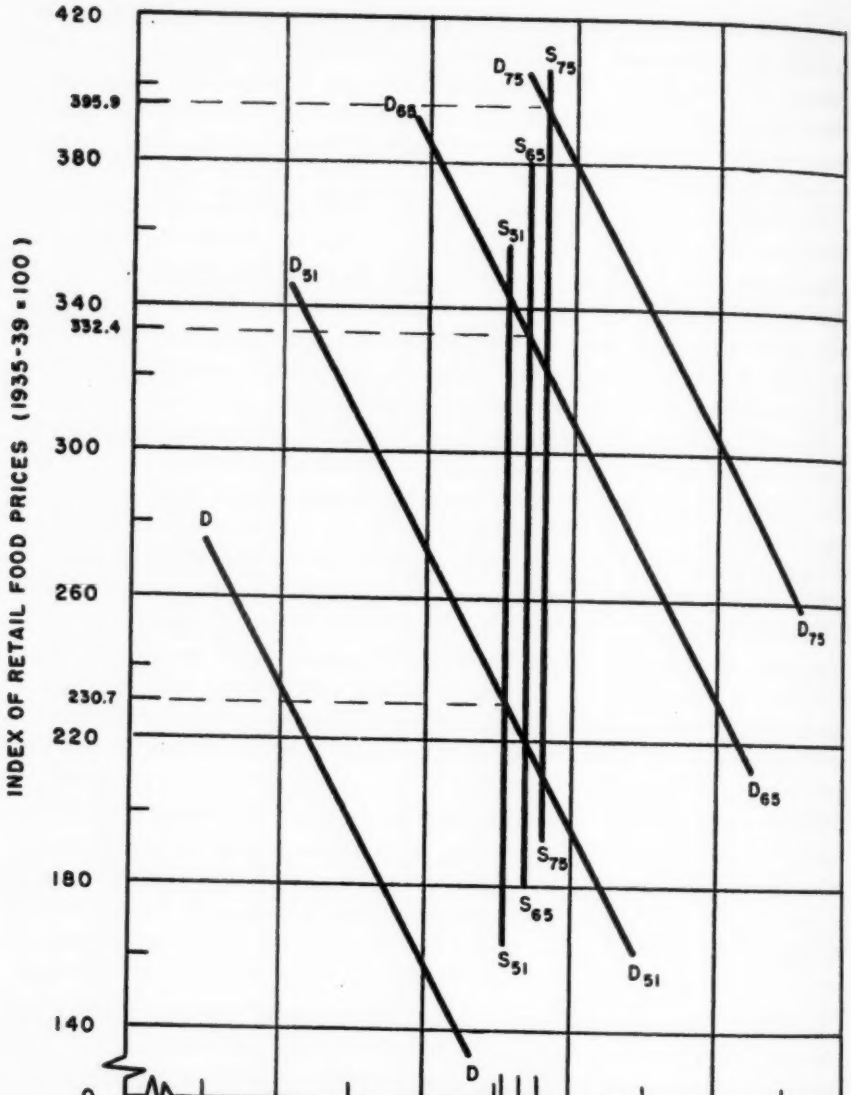

FIG. 2.—FOOD PRICE LEVEL MOVEMENTS, CHRONIC HOT AND COLD WARS, 1951–75

vary with price level changes, the supply function is perfectly inelastic throughout. This being the case, the quantity results in the equilibrium solutions that follow are identical with—and are determined by—the index values of per capita food consumption given for the years 1965 and 1975 in Table 1. Where quantities are given, the price level results of the equilibrium solutions depend upon shifts in the demand function.

Shifts in the aggregate demand curve for food in this analysis are dependent upon changes in income alone; the demand curve is driven to the right by the force of expanding personal disposable income.[12] These shifts in the aggregate demand for food between 1951 and 1965 and on to 1975 for Situation I are portrayed graphically in Figure 2. The points of intersection of the rapidly expanding demand curve with the perfectly inelastic supply curves describe the possible nature of free movements in the retail price of food over an extended period of flashing hot and cold wars. We observe that the equilibrium price level solution for 1951 is 230.7[13]; it rises dramatically to 332.4 in 1965 and on to 395.9 in 1975 (these price solutions were derived algebraically and are presented graphically in Fig. 2 for convenience). The terms of trade turn heavily in favor of the farmer under this path of development since food prices rise about 72% above the 1951 levels during this period and the general price level increases only 45%.

These solutions in terms of retail prices may be translated into values of the index of prices received by farmers for food via the following relationship obtained from the period 1920–50: $Y = -41.21156 + 1.39447X$, where Y is the index of prices received and X the index of retail prices. This relation encounters certain logical difficulties, however, since farm prices cannot indefinitely increase more rapidly than retail prices. Thus

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[12] The mechanics of the shifting action are enumerated here with an illustration of the calculations of the solution values for 1965, Situation I.

(1) The device for shifting the demand curve DD was derived from the high income periods 1939–42 and 1948–51 in an effort to obtain relationships appropriate to the long-run situation under consideration.

(2) The regression line DD was passed through the *actual* price-quantity points for each year in the above periods and the regression equation ($Y = A - 4.97508X$, see Footnote 4) solved for A. The A values for each year were correlated with the index of per capita disposable income to yield the relation $A = 513.62681 + .95827X$ (Income) ($r^2 = .990$). Substituting the 1965 value for income (403.3) in this relation we get $A = 513.62861 + .95827(403.3) = 900.09710$.

(3) To position the demand curve for any year the calculated A value is substituted in the generic demand equation $Y = A - 4.97508X$. Thus the demand equation for 1965 is $Y = 900.09710 - 4.97508X$.

(4) The price solution is obtained by substituting the estimated index of per capita consumption for X in the demand equation, for 1965 the estimated index is 114.1 (see Footnote 9) and the estimated index of retail food prices for 1965 is $Y = 900.09710 - 4.97508(114.1) = 332.44047$ or 332.4.

[13] The actual index of food prices at retail was 227.4 in 1951.

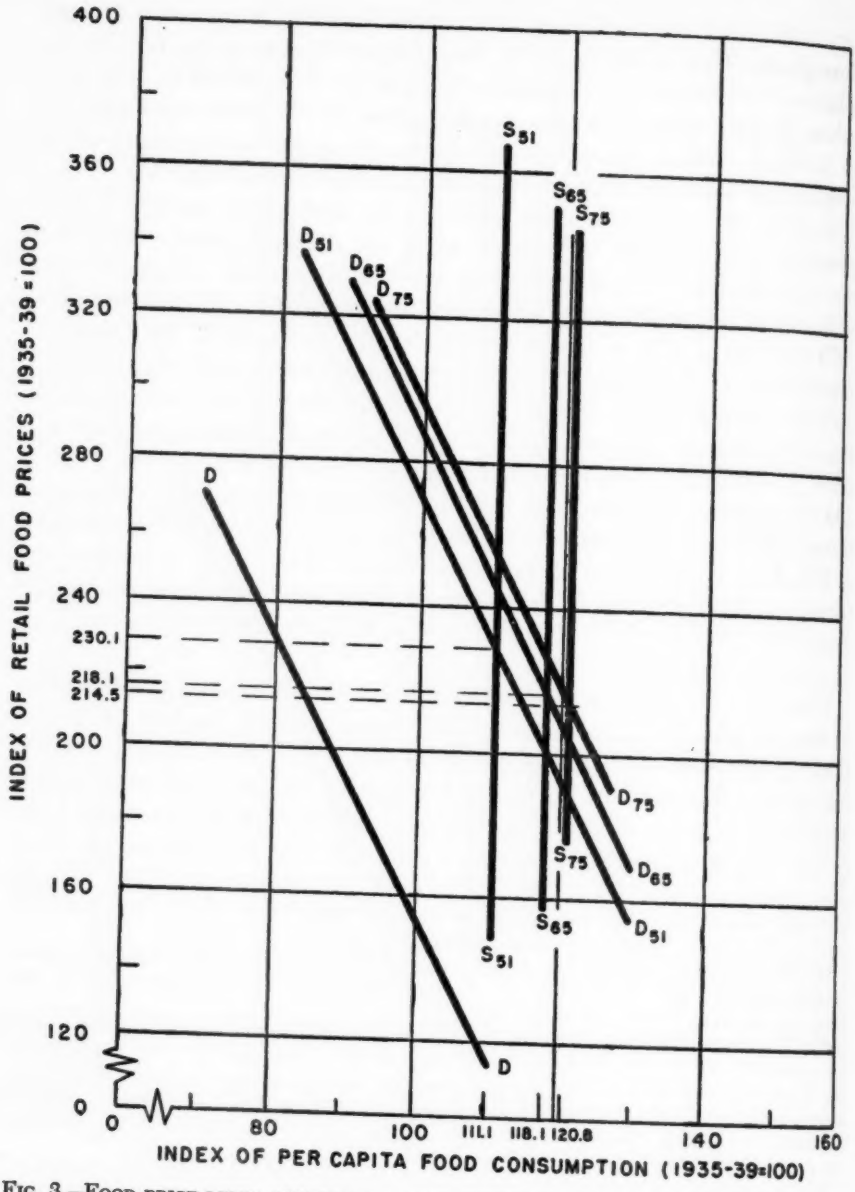

FIG. 3.—FOOD PRICE LEVEL MOVEMENTS, CONTINUOUS PEACETIME PROSPERITY, 1951–75

the solutions obtained in translating retail prices to the index of prices received should be viewed as suggested possibilities, not precise answers. Using the above relation we obtain the following results: the index value of prices received by farmers for food is 280 in 1951, it rises to 422 in 1965, and on to 511 in 1975.

Situation II, Continuous Peacetime Prosperity, is portrayed in Figure 3. The price level for food at retail falls modestly from 230.7 in 1951 to 218.1 in 1965 and then on to 214.5 in 1975. These solutions convert to the index of prices received as follows: 280 for 1951, 263 for 1965, and 258 for 1975.

A modest downward drift in the retail price level for food emerges in Situation II in contrast to Situation I because of changed conditions on both the demand and supply sides. The aggregate demand curve for food, shifts to the right more slowly in Situation II than in Situation I because money incomes are increasing more slowly in the former situation than in the latter (compare Tables 1 and 2). The index of per capita food consumption, hence the supply function, expands more rapidly in Situation II than in Situation I, even though the rate of output expansion is the same in both situations, because in the case of continued peacetime prosperity exports are down and military takings are down. The effect of these changes in the supply influencing factors is to increase the supplies available to civilian consumers on a per capita basis. The net effect of these changed conditions on the demand side and the supply side, relative to Situation I, is to create some "softening" in food prices, even though general economic conditions are assumed to be good.

Situation III will be passed over hurriedly, and is presented here only to fill out the panorama of possibilities. The price level solutions for Situation III are similar to Situation I through 1965: 1951 = 230.7, 1965 = 332.4. For Situation III a downturn in economic activity occurs following 1965. The retail price level for food falls to 266.7 as of 1970.* This equilibrium price level of 266.7 converts to the index of prices received at 331. Thus, we gain some impression of the force of a serious economic depression on food prices; retail prices fall some 65 points on the index between 1965 and 1970 and prices received fall about 90 points.

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The price level consequences for food under the assumed situation of chronic hot and cold wars are extreme indeed. But we will remember that the price level solution of 396 as of 1975 is an equilibrium solution for an essentially uncontrolled economy. The increase of 165 points on the index of the retail price of food between 1951 and 1975 is in no sense a prediction, and we would think that such an increase is unlikely to occur even

* See footnote 11, page 215.

if chronic hot and cold wars are to be our lot for the next 25 years. The extreme character of this rise in the equilibrium level of food prices would militate against its occurrence. We would expect the federal government to take all types of action, direct and indirect, to reduce the inflationary pressures that would give rise to such a great increase in the price of food—a principal item in the cost-of-living.

Unreal as these equilibrium price solutions may be in terms of what could happen, they do make two points abundantly clear: (1) the upward pressure on food prices would be tremendous in a continuous war climate, and controls designed to keep food prices from rising rapidly would need to be well conceived, firm, and persistent, and (2) the farmer would find the demand for his products strong, his prices relatively high, and his economic position very good.

Food prices at retail and the prices received by farmers for food decline gently but persistently over the period 1951–75 in Situation II, Continuous Peacetime Prosperity. The nature of these equilibrium solutions suggests, for the situation under consideration, that, first, the aggregate supply of food might be expected to slowly outdistance aggregate demand in the long-run race between the two, and second, the real income position of food producers might be expected to deteriorate modestly. This analysis offers evidence that we may expect some pressure of food supplies on demand in the United States, if we are so fortunate as to avoid war on one hand and depression on the other, in the long-run future.

This appraisal of peace, prosperity, and agriculture runs counter to the Malthusian overtones found in the leaflet "The 5th Plate."[14] Our analysis would seem to be moving in the same direction as agriculture itself during that brief period of normalcy, 1949 through the first half of 1950—namely toward surplusses. And, of course, when the terms of trade turn against agriculture, real incomes in agriculture deteriorate. This is what we witness in the falling food price level solutions in Figure 2, where the general price level is assumed to be constant.

One relationship mentioned in an early section of this paper was not incorporated into the operational system. We refer to the expectation that the proportion of income allocated to the purchase of food[15] will decrease through time as real incomes rise. Every careful cross-sectional budget study from the days of Engel to the Food Consumption Surveys of 1948 conducted by the U.S. Dept. of Agriculture[16] brings out this relationship.

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[14] *The 5th Plate*, U.S. Dept. of Agriculture, PA–191, December, 1951.

[15] We refer here specifically to the quantity or value of *food* purchased, not to the additional services that may be acquired with that food (e.g., eating in restaurants, more processing per food item).

[16] See the Commodity Summaries No. 1 through No. 11, U.S.D.A., August, 1949 through April 1951.

The long range work of Colin Clark describes this dwindling proportion of a society's efforts and expenditures devoted to food in terms of a movement away from primary industries (e.g., agriculture) to secondary industries (e.g., manufacturing) and on to tertiary industries (e.g., service trades).[17] We conclude that, in a long-run analysis such as this one, the aggregate demand curve for food should be shifted to the right as per capita real incomes increase by some coefficient which becomes gradually smaller as incomes increase through time. Such a realistic treatment, if we had been able to develop a slowly contracting income shifter[18] from historical data, would have had the effect of slowing down the movement of the demand curve to the right, hence further reducing the level of food prices in the equilibrium solutions for Situation II. In other words, we would conclude that the effect of the one important long-run force not considered in the operational system would be that of further dampening the long range outlook for food prices. This leads to an even greater skepticism of the implied fear of food shortages for the United States to be found in The 5th Plate argument, except in the case of all out war. There is never enough food in wartime.

One further qualification needs to be made at this time with respect to the foregoing equilibrium price level solutions, and this qualification has perhaps more serious implications for our analytical method than the point discussed above. After adjustments are made for quantities imported and exported, the above price level solutions are derived as if the United States were isolated from the rest of the world (i.e., the method presumes that all food prices are determined within the United States as the result of domestic forces). No problems arise with respect to this procedure for that broad category of commodities whose prices are in fact "made" in the domestic market. But there are some important exceptions—notably wheat, fats and oils and sugar; prices of these commodities tend to be "made" in world markets. Now where the world food situation is such, perhaps critically short, perhaps exasperatingly long, the world price of these exportables will tend to fluctuate more than the comparable domestic model (e.g., Situation II) would dicate. Thus the food price level in the United States may fluctuate more in fact than the above price solutions would suggest.

The down turn in farm prices in United States over the past winter appears to be just such a case. Prices of exportable commodities, and close substitutes of those commodities, in the United States have fallen by more

[17] *The Conditions of Economic Progress*, Macmillan & Co. Ltd., London, 1940.

[18] Instead, we developed a constant income shifter of the demand curve for the high level years 1947 through 1952 in an effort to obtain a reasonable relationship between changes in the amount of income received and the proportion of that income allocated to food.

than the domestic model (i.e., Situation I) would suggest by reason of the "improved" world supply situation. We might generalize as follows: the intensification of war and war efforts throughout the world with the attendant premiums on food stocks has the influence of driving food price levels in the United States higher than those indicated in our models, whereas the intensification of peace and peaceful pursuit with the attendant growing supplies has just the opposite influence.

Like the hot and cold war situation, the implications, to food producers, of a serious depression are obvious—so obvious that we would not expect the equilibrium price level solutions that we found for Situation III to ever exist in fact. The extreme nature of the price level decline in Situation III suggests: (1) that measures would be instituted to combat this break in prices, but (2) that those measures would need to be intelligently conceived and executed with courage and strength of purpose if they were to prevail.

Summary

This analysis indicates that the current concern over possible food shortages for the long-run in the United States is unfounded, except under conditions of continued war or threat of war. The gently falling food price level isolated under Situation II would indicate a modest pressure of food supplies on demand, given continued peacetime prosperity. The severe inelasticity of the aggregate demand for, and aggregate supply of food gives rise to wide price fluctuations as the general economic climate moves from that of war to depression. Once again, the inherent and extreme price instability of agriculture is called to mind.

SOME ECONOMIC IMPLICATIONS OF INPUT-OUTPUT RELATIONSHIPS IN FRYER PRODUCTION*

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Introduction

POULTRY meat enterprises considered in isolation from complementary, supplementary, and/or resource competing farm enterprises (including previous and subsequent lots of fryers) offer a comparatively simple vehicle for studying some techniques for determining appropriate input-output relationships and related feed utilization problems. The input-output relationships which are to be considered here contribute to the understanding of practical management decision-making in which attempts are being made to maximize profits within the imposed constraints of imperfect physio-technological knowledge (in this case, the single-enterprise firm producing a single product from a single variable factor, given any physical plant).

Under usual commercial operating conditions, the manager starts the production period at the time he purchases a lot of day-old chicks of a suitable meat-producing strain of males, females, or straight-run (unsexed). The selection of the chicks is one of the more important decisions made by the manager of the fryer enterprise. The chicks are in fact the focus around which all the physically involved management decisions are made. Each chick embodies a bundle of biological attributes, varying about some modal condition.

The particular attributes desired in the meat strain are those which contribute to a high physical efficiency in the transformation of productive factors into high quality meat, desirable feathering characteristics, and the like. Under the current conditions of commercial operation, it is important that these attributes be rather uniformly distributed among the individual birds.

Input-Output Considerations

The nature of the enterprise is intimately linked to the biological attributes of the fowl. The life processes of the individual birds must be maintained within certain allowable environmental limits. The life-supporting resource matrix is composed of both fixed and variable resources, each of which varies in importance with environmental conditions and the physiological age of the bird.

* Scientific Paper No. 1184. Washington Agricultural Experiment Stations, Pullman. Project No. 819.

The input-output relationships with which we will be concerned in attempting to demonstrate the economizing techniques of the poultryman are those with which he is confronted under his unique conditions. These pertain to the use of feed in the production of fryers. We are interested in developing the rationale which may be employed by any poultry meat producer for any given lot of fryers, rather than the problem of estimating parameters for a population of poultry enterprises. Production functions, linear in logarithms, derived from cross sectional studies (e.g., farm business records) do not adequately provide the entrepreneur with relationships constructive to the profit determination, decision-making process for any given lot of fryers. Each lot is unique. Once committed to a lot of birds and a fixed plant, the only *important* factor of production that the entrepreneur may vary is feed—and that only gradually through time.

The general form of the input-output relationships operative under given combinations of technically fixed environment-producing resources, indicates a unique relationship between feed inputs and live weight outputs. This relationship takes the form of a single-valued, monotonically increasing function. The ordinate of the function may begin at some positive value only after a large proportion of the total input of feed is applied, or it may begin at some positive value for zero inputs of feed. The former type of function is characterized by those enterprises in which some maintenance need is satisfied by a portion of the variable input, in which case no product can be generated until the maintenance requirement is satisfied. The latter is characterized by those enterprises in which some positive amount of the product has been introduced into the production picture as a fixed element (weight of day-old chick).

These two types of physical relationships in poultry enterprises may be further characterized with respect to time. Those that involve some maintenance prior to production, and the relative levels of output—depending upon the intensity of factor application—may be more accurately understood as an intra-temporal relationship. The input-output curve beginning at some positive value ($X = 0$) may be more adequately interpreted as inter-temporal. Admittedly, in either case, changes in the total product are manifested over time, but the management decision relative to the quantity of inputs (feed) results in an instantaneous intensity of factor application in the former case. The intra-temporal input-output relationship is the result of existing efficiency complexes in the fryers, while the inter-temporal relationship results in part from their momentarily existing efficiency complexes, from attempts to economize relative to the intra-temporal relationships, and from changes in their efficiency complexes through time.

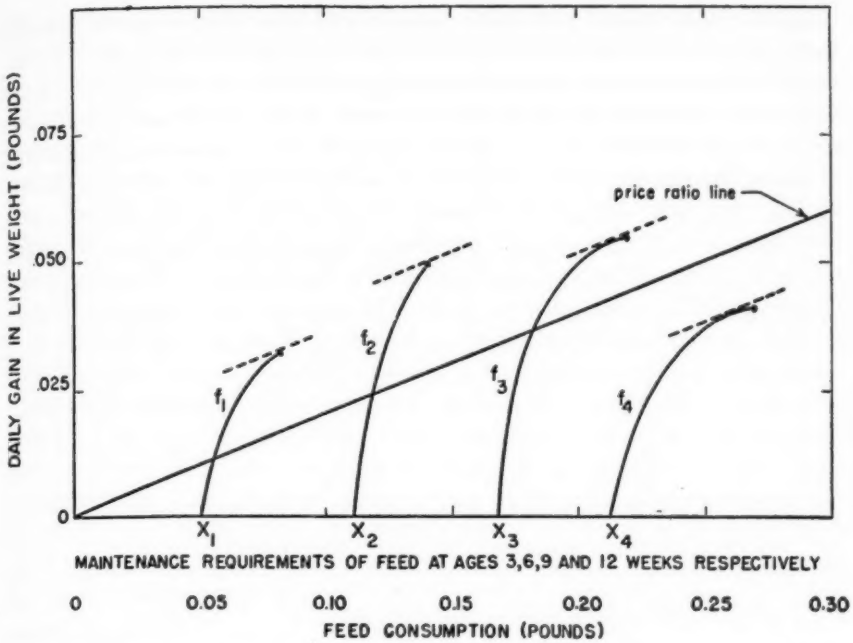

FIG. 1.—INTRA-TEMPORAL INPUT-OUTPUT RELATIONSHIPS IN FRYER PRODUCTION.[a]

[a] The average weights of birds at the four stages of growth are estimated as follows: 3-week old fryers = 0.439 pound; 6-week old fryers = 1.362 pounds; 9-week old fryers = 2.461 pounds; 12-week old fryers = 3.424 pounds. Feed maintenance requirements in pounds were determined as follows: $\log y = \log 0.09 + 0.7 \log W$; in which y = pounds of feed for maintenance, and W = live weight of the fryer.

Intra-temporal Input-Output Relationships[1]

The maintenance requirement of the fryer satisfies the needs of basic metabolism, exercising energy, and the energy requirements for the digestion of food. Approximately 85 per cent of the maintenance energy is required for basal metabolism which increases as the 0.7 power of the body weight. Exercise metabolism, however, increases in a direct proportion to the body weight. But as the bird becomes heavier it tends to exercise less frequently, so in effect the exercise metabolism also tends to increase as the 0.7 power of the body weight.[2] Conceptually then, the intra-temporal relationships will tend to increase and then decrease as the age of the fryer advances (Fig. 1).

[1] This section is based on experimentation closely related to this general subject but not specifically designed to verify our hypothesis concerning intra-temporal input-output relationships in fryer production.

[2] Samuel Brody, *Bioenergetrics and Growth*, Reinhold Publishing Corporation, 1945, p. 470.

As the bird gains additional weight and size, the requirements for maintenance increase from X_1 to X_4. Quantities of feed fed daily in excess of the maintenance requirements make possible the accumulation of body weight, as indicated by the functions from f_1 to f_4.[3] Since so much emphasis is placed on daily rate of gain in fryer feeding operations, the nature of these functional values is important in determining the appropriateness of this emphasis.[4] The most economical level of feeding will depend upon the nature of the intra-temporal relationship, and possibly the ratio of the expected price of the marketed product to the feed cost. The usual price ratios of fryers to feed appear to be high enough (approximately 5 to 1) so that no economizing problem is involved when the birds are 3 or 6 weeks old, as indicated by f_1 and f_2, respectively. It would be most profitable then to feed the birds all they would eat at these stages of development. However, as the fryers approach 9 or 12 weeks of age (as indicated by f_3 and f_4, respectively) it would be most economical to feed less than the maximum which the birds would consume. If it is most economical to feed at less than "full-feed," some difficulty may attend the entrepreneur's attempt to employ this information effectively, since fryers are universally fed on a communal basis. Hence, the larger more aggressive birds would tend to get "full-feed," while some of the birds in the lot would get appreciably less than would be desirable. This undesired effect might be partially reduced by feeding rations of lower nutrient concentration, but this might reduce the economies associated with large quantity production of a uniform commercial fryer feed.

Inter-temporal Input-Output Relationships

The inter-temporal input-output relationship of any lot of fryers provides one of the most useful mechanisms contributing to feed economizing by management. Since this relationship, and managerial decisions relating to it, occurs through time, decisions may be made and the results employed without resort to any technique of experimentation involving what might have been (except insofar as what might have been concerns price or physical relations of inputs to outputs after the fryers have been sold). The entrepreneur is concerned with the problem of determining the input-output relationship for his particular lot of fryers within desired confidence limits.

The production functions may be determined with respect to feed

[3] $f_1, \ldots, f_4$ represent instantaneous feed conversion relationships for increasing bird weights. $X_1, \ldots, X_4$ in Figure 1 represent birds of increasing weights and their maintenance requirements.

[4] H. W. Titus, M. A. Jull, and W. A. Hendricks, "Growth of Chickens as a Function of Freed Consumption," *Journal of Agricultural Research*, Vol. 48, No. 9, May 1, 1934, pp. 830-833,

inputs through random sampling ($n < 0.05$) of individual bird weights and imposing the assumption of an average feed consumption per bird and normality of population weight distribution. Sample size is determined by (a) size of the lot of birds, (b) allowable deviation, (c) individual bird weight variance of the lot, and (d) the desired probability level of significance. The over-all objective is to select a sample of birds such that the sample estimator ($\bar{X}$) of the population parameter (μ) will have a limiting variance smaller than any other estimate of (μ). It may be assumed that the distribution of individual bird weights is approximately normal, although it may be a slightly truncated normal distribution. Truncation occurs because the aggressive manager constantly culls slow growing and sickly birds, but ordinarily does not separate from the remainder of the flock the very rapidly growing birds. As a result, the truncation occurs on the lower end of the weight distribution, causing an unequal variance plus and minus the population parameter (μ). Weight variability among birds in any lot tends to increase at an increasing rate as the average weight of the birds in the flock increases. This probably results because of the various efficiency complexes among birds which result in some birds reaching a relatively heavier weight at an earlier age than other birds in the same lot.

The inter-temporal input-output curve takes the modified exponential form

$$W = M - Ae^{-kx} \tag{1}$$

where W represents the total weight of the fryer when x units of feed are applied; M represents the limit approached by W as x increases indefinitely; A represents the theoretical maximum increase in weight obtainable by increasing x indefinitely; and e^{-k} is equal to the inverse ratio of the gains in live weight resulting from any two successive units of feed consumed. The value of e^{-k} depends on the size of unit in which x is measured, on the nature of the variable factor, and on the environmental conditions of growth.

The marginal physical productivity of feed in this case is obtained from equation (1) by differentiation, yielding

$$\frac{dW}{dX} = KAe^{-kx} \tag{2}$$

Equation (2) representing the physical efficiency of successive incremental inputs of feed decreases in a geometric progression. The magnitude of this decrease is determined by e^{-k}.

The approximate values for the three parameters in the functional equation may be determined provided the gains of the birds for unit

increments of feed consumed are known.[5] After obtaining the approximate values of M, A and K, the following adjustment equation is employed to determine corrections to be made to the approximate values of the parameters:

$$(3) \qquad \frac{\partial W}{W_o \partial M_o}\mu + \frac{\partial W}{W_o \partial A_o}\alpha + \frac{\partial W}{W_o \partial K_o}\varkappa = \frac{W - W_o}{W_o}$$

in which $$\frac{\partial W}{\partial M_o} = 1; \frac{\partial W}{\partial A_o} = -e^{-k_o x}; \frac{\partial W}{\partial K_o} = XA_o e^{-k_o x};$$

and μ, α, and $\varkappa$ are corrections to be made to M_o, A_o, and K_o which are approximations previously obtained of the constants M, A, and K; W and W_o are the observed and calculated live weights. The corrected values of M, A, and K are readjusted until the corrections become negligible. Equation (3) reduces the sum of squares of the relative residuals to a mini-

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[5] The following method of approximating the functional parameters yields a value of M which makes the values of log (M − W) lie most nearly along a straight line when plotted against corresponding feed inputs (X) as abscissae. The differential form of

(1) $W = M - Ae^{-kx}$ may be written

$$(2) \qquad \frac{dW}{dX} = B - nW, \text{ in which } B = kM, \text{ and } n = k$$

If finite increments are substituted for the infinitesimals of (2) the working equation becomes $\frac{\Delta W}{\Delta X} = B - nW$, in which the ratio, $\frac{\Delta W}{\Delta X}$, represents the gain in liveweight per unit of feed consumed over a short interval of time. W represents the average liveweight of the fryer during this short interval of time, calculated by adding one-half of the liveweights at the beginning and at the end of the particular interval. The values of the ratio, $\frac{\Delta W}{\Delta X}$, for consecutive intervals of time lie along a straight line when plotted against the corresponding values of W as abscissae. Hence, a simple linear equation ($y = a + bX$) may be easily fitted to such a set of data by the method of least squares. The slope of the fitted line is −n. The intercept of the line on the axis of coordinates is B since when $W = O$, $\frac{\Delta W}{\Delta X} = B$ the intercept of the line on the axis of abscissae gives the mature weight of the fryer, since when $\frac{\Delta W}{\Delta X} = O$, $nW = B$; or $W = \frac{B}{n}$, or M. The value of A in (1) may be calculated by subtracting the initial weight of the chick from the mature weight of the fryer (M). The values of B (nW) represent the efficiency of feed for growth. Cf. W. A. Hendricks, *Science*, Vol. 74, September, 1931, pp. 290-291.

mum. In order to estimate a population parameter (μ) from week to week as the birds grow older and increase in weight within specified confidence limits, the number of the birds in each sample becomes an increasing function of the flock average weight because of increasing variability.

Since the birds are fed on a communal basis, no accurate data are available with respect to the particular quantity of feed consumed by each bird in a sample. On an a priori basis, it is plausible to assume that the individual bird weights in the sample (and in the whole lot) are to a large degree a function of the feed consumed. The standard error of the mean production curve of the birds in the flock is greater than that which actually exists (Fig. 2).

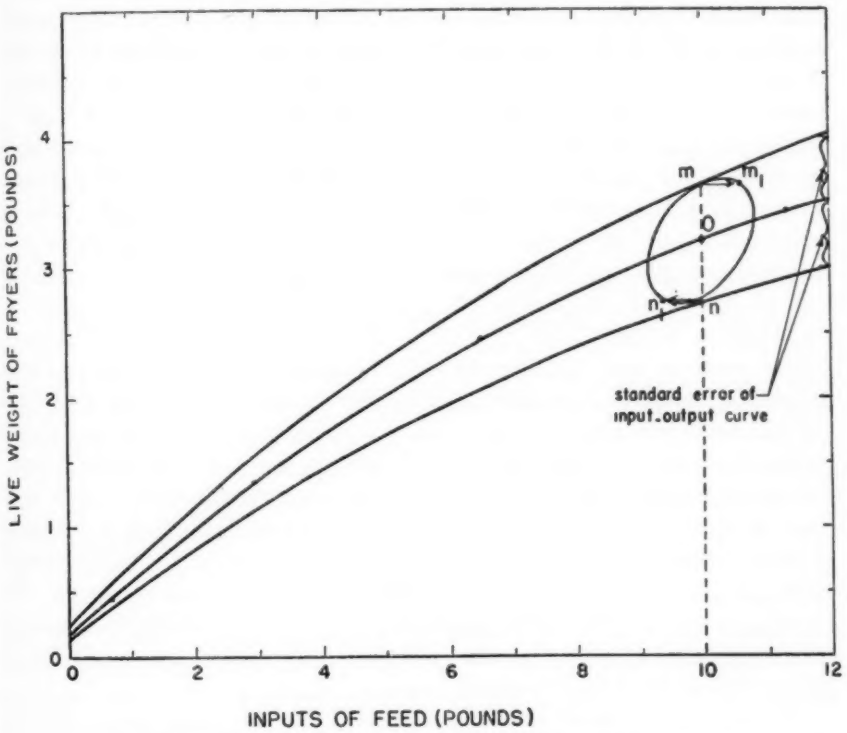

FIG. 2.—REINTERPRETATION OF INPUT-OUTPUT COORDINATES FOR INDIVIDUAL BIRDS WITHIN A LOT.

Although m and n are plotted in relation to an average feed consumption, they ought to be plotted at m_1 and n_1, respectively, relative to a more realistic feed consumption by individual birds. The coordinates of individual birds should cluster around 0 in an elliptical fashion with decreasing orders of concentration radiating from 0. The scatter of coordinates, however, should not lie symmetrically in vertical and horizontal

planes, but should be in a somewhat elongated, modified elliptical fashion —diagonally upward to the right and downward to the left from 0. If each coordinate were traceable under commercial operating conditions, then each bird's production period could be terminated relative to its own input-output curve. This practice may be carried on economically in the production of large animals but, due to the economies of scale of mass production techniques (involving communal feeding), economizing should be accomplished on a flock basis in fryer enterprises.

Insofar as managerial decisions relative to the appropriate weight at which a lot of fryers should be marketed may be made on a "flock-run" basis, the coordinates determined on an average bird weight average feed consumption basis is sufficient. Frequently, however, growers follow a practice of "topping-out" each lot of fryers, i.e., they select the heavier birds out of the flock (those over 3.0 pounds) when approximately one-half of the birds in the lot weigh in excess of 3.0 pounds. The heavier birds, however, would undoubtedly eat more on the average than all birds in the lot. So an input-output relationship for either the large or small-sized birds relative to an average feed consumption would indicate an incorrect relationship. As a result, producers who attempt to "top-out" a lot of fryers cannot be certain of the nature of the particular input-output relation with which they are attempting to economize.

Input-Output Relationships as a Guide to Profit Determination

The product and factor markets confronting the individual manager approaches a perfect market. Proceeding on the assumption that fixed factors have been employed in such a manner that their marginal physical productivity is proportional to their prices, the variable factor (feed) should be added until its marginal revenue product equals the price of feed. However, restraints, e.g., indivisibility of certain factors, inflexibility of factor combination or recombination, technological and price uncertainty on both the factor and product side, and imperfections in the knowledge of the estimated input-output curve applicable to a unique enterprise, operate to reduce the manager's effectiveness in achieving an unconstrained level of net revenue.

The most economical level of production may be determined after the physical input-output curve is partially established and the prices of the variable factor and the product are estimated. Production should proceed to the point (if attainable) where the derivative of the input-output equation is equal to the price ratio of input to output. This condition may be represented by $\frac{dW}{dX} = \frac{P_x}{P_w}$. It may be conveniently developed by utilizing

the physical input-output curve and a value-equating line drawn from the origin and sloping upward to the right in accordance with the particular ratio. A parallel from the value-equating line tangent to the total product curve indicates the optimum level of output and the physical product above the quantity of output required to cover the variable input costs. If it is desired to inject various elements of fixed factor costs into the graphic presentation, a new value equating line parallel to, but above, the one passing through the origin may be constructed. The magnitude of the difference between the corresponding ordinal values is determined by the quantity of product, at the price under consideration, required to cover the fixed cost. The value-equating line ($y = a + b X$) increases at a constant rate because the price paid for the live fryer is constant regardless of the average weight of the lot of birds (within the 2¼ to 4 pound range).

Price-Ratio Considerations

As the production period advances, a relative change in the cost of feed will have a much smaller impact on the net returns to the enterprise than a similar change in the price of fryers (Fig. 3). Similarly at equal bird-weights, feed-price ratios will result in different profit levels, depending upon the components of the ratios and the magnitude of the fixed costs.

The economizing process is demonstrated in Figures 3A and 3B, relative to a live weight-feed price ratio of 5 to 1 during the period of feeding from 0 to 6.9 pounds. Beyond the 6.9 pound level of feed input, the live weight-feed price ratio changes to 4 to 1. This change in the live weight-feed price ratio results from (1) an increase in the price per pound of feed with the price per pound of fryer remaining constant (Fig. 3A), or (2) from a reduction in the price per pound of fryer with the price per pound of feed remaining constant (Fig. 3B). The optimum level of feed input at the time the production period should be terminated is reduced from 9.2 pounds to 6.9 pounds in both cases. Although the two cases are representative of equal live weight-feed price ratios throughout the production period, the impact on net revenue is much greater in the latter than in the former case, i.e., net revenue remains positive in the former case and becomes negative in the latter.

Innovations

Variable Factors—High Energy Rations and Antibiotics—The impact of the high energy rations, antibiotics has been significant because they have increased the marginal physical productivity of the feed. These innovations essentially increase the values of the input-output equation parameters, M, A, and K, discussed above.

The economic problem is the determination of the economic feasibility

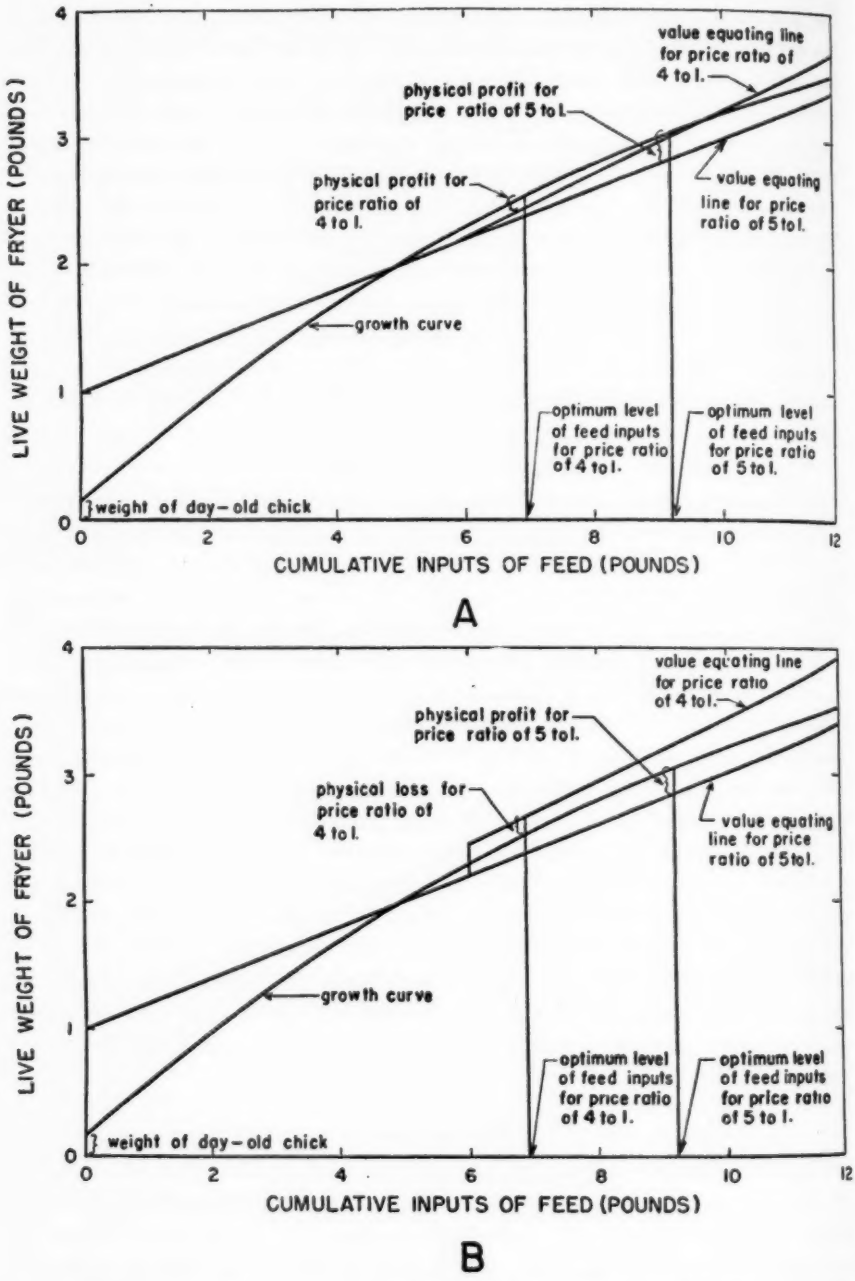

FIG. 3.—THE EFFECT OF RELATIVE CHANGES IN THE PRICE OF FEED (A) AND THE PRICE OF FRYERS (B) ON THE NET REVENUE.

of adopting a particular innovation—i.e., does the added expense yield a greater net revenue at the margin? Diagrammatically, the analysis should determine whether the gradient of the total product curve is increased relatively more than the gradient of the value-equating line at any given feed input (X_1). If this result does occur, it would mean that, *cet. par.*, the adoption of the innovation would result in a greater net revenue (Fig. 4).

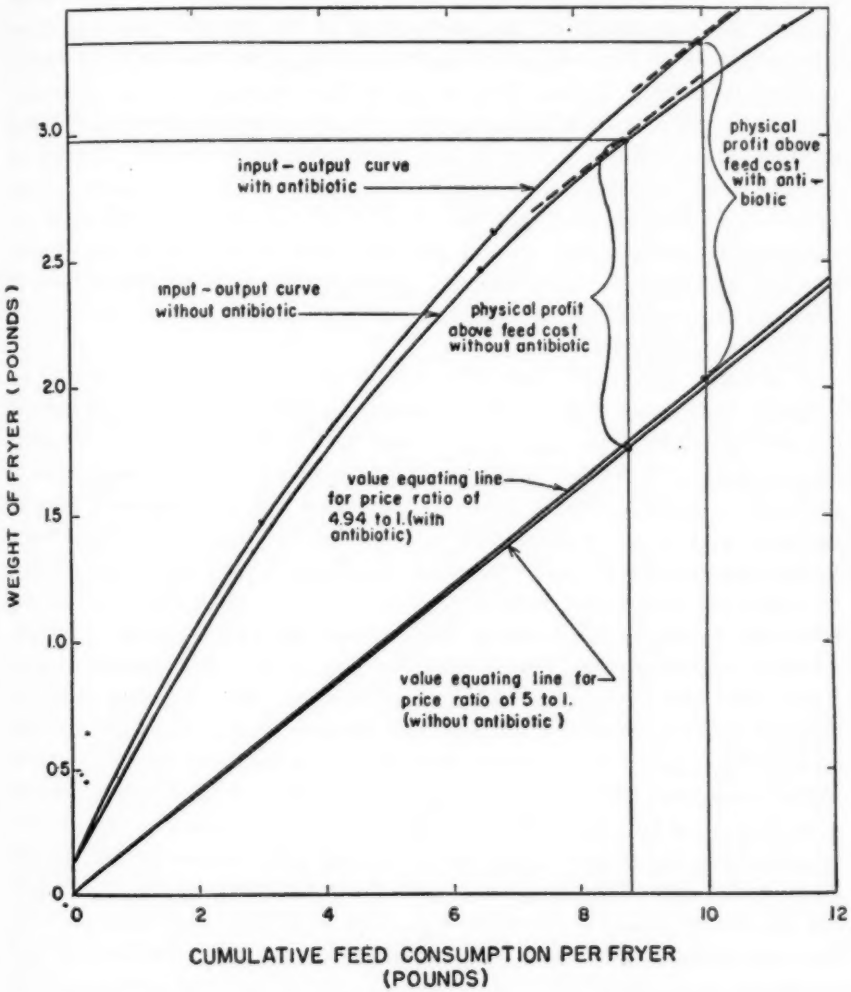

FIG. 4.—NET REVENUE AS AFFECTED BY THE ADOPTION OF AN ANTIBIOTIC ADDED TO A HIGH ENERGY RATION.[a]

[a] Comparative technical input-output data (high energy vs. high energy plus an antibiotic) furnished by the Poultry Science Department of the State College of Washington.

In each case, the adoption of the innovation resulted in a highly significant ($P < 0.01$) increase in the total product for a given amount of feed inputs. Similar results have been found under commercial operating conditions—fryers now attain an average of 3 pounds of live weight from 9 to 10 weeks of age instead of 12 to 13 weeks of age.

Fixed Factors—Equipment, Buildings, and Chicks—Innovations in equipment and buildings are important to the manager because they influence the magnitude of the parameters of the input-output equation. The adoption of these types of innovations may be of a cost decreasing or cost increasing nature. For example, the adoption of an automatic feeder may be cost decreasing on a large scale enterprise previously using a large amount of labor. However, if similar equipment were adopted on a small scale enterprise, it might increase fixed costs to the point where net revenue may be zero or negative. Prior to adoption, the effect on the cost-revenue relationship should be fully studied to determine its economic advantage or disadvantage, because these innovations tend to increase the magnitude of the total product curve (or total revenue) as well as the cost curve.

A possible constraint that may inhibit the adoption of a capital increasing innovation may be the desired liquidity preference position of the entrepreneur. The high risk nature of the fryer industry, resulting from technical and price uncertainty, forces the prudent entrepreneur to maintain a working liquid reserve. Therefore, the management may be satisfied with a net revenue that is less than the maximum net revenue under unconstrained conditions. This condition may force fryer growers to construct less costly buildings, thereby decreasing the level of the total cost schedule and possibly the level of the total revenue schedule. Another condition may reveal that the use of low cost buildings may lower the total revenue schedule and increase the total cost schedule through greater mortality, disease, and repairs. This is in effect the cost of insuring against uncertainty through less investment in assets which would necessarily be fixed over a greater number of production periods.

Management is faced with the alternatives of purchasing chicks of varying efficiency complexes. These are associated with various strains, breeds, sexes, and crosses. Usually price is directly associated with the chicks having the more desirable qualities, e.g., high feed-meat conversion ability, less variability in growth of birds within a lot, desirable feathering characteristics, less flightiness, and the like. The problem then arises as to the desirability of purchasing the chicks with greater or less of the inherent desirable characteristics. This economic problem is resolved by comparing influences of the bird qualities on the net revenue schedule. If the efficency complex is not uniformly distributed among chicks in a lot, the

grower may be penalized for excessive variability in fryer weights at marketing time through a lower average price than other growers receive. Hence, the distribution of efficiences as well as the average efficiency of a lot must be considered when purchasing day-old chicks. A newly developed hybrid which displays high average efficiency may not warrant an increased price per chick if the efficiency attribute is not uniformly distributed among the chicks.

PRICES AS INDICATIVE OF COMPETITION AMONG RETAIL FOOD STORES*

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COMPETITION among retail food stories is a complex and dynamic phenomenon. Assessing this competition requires a study of both price and non-price factors. The price aspect is complicated by the large number of items usually carried[1] and the interrelationships of demand among many of them. Among the non-price factors is the unlimited opportunity for product differentiation in terms of location, brands carried, services offered, the personality of the manager, the layout, decorations, and atmosphere of each store.

There is a need for a better understanding of retailing functions and the kind of competition retail stores face and create. The margin taken by retailing is usually larger than that of any other single marketing agency. This margin is to some extent determined by the level of competition existing in specific markets, yet there is little data, or few studies, available to assist in judging that competition.

The object of this paper is to evaluate the use of uniform prices among outlets in a market as a means of judging the level of competition existing and to relate the implications to merchandising and marketing research. It will be shown why retail prices are more variable than prices for the entire market baskets offered by retail stores, and why such retail prices are more variable than wholesale prices. It is hypothesized that because of institutional factors, competition for one item is much more restricted in multiple-product markets than in single-product markets. Farm and wholesale markets are usually single-product markets whereas retail markets are usually multiple-product markets. Hence the characteristics and objectives of the buyers in these two types of markets may be quite different. Retail food stores are the most important type of multiple-product market in which each commodity is considered as *part of a group* rather than individually.

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** Also Cooperative Agent, Bureau of Agricultural Economics, USDA.

[1] Super markets in Los Angeles carried about 3,500 separate items at the time of this study.

Marshall commented on prices in retail as compared to wholesale markets in the following words:

> A man may not trouble himself much about small retail purchases: he may give half-a-crown for a packet of paper in one shop which he could have got for two shillings in another. But it is otherwise with wholesale prices. A manufacturer cannot sell a ream of paper for six shillings while his neighbor is selling it at five. For those whose business it is to deal in paper know almost exactly the lowest price at which it can be bought, and will not pay more than this. The manufacturer has to sell at about the market price, that is at about the price at which other manufacturers are selling at the same time.[2]

Perfect Competition Among Retail Food Stores

Uniform prices for a given commodity among different outlets in the same market has been considered as one of the most important results of perfect competition. This situation has been expressed as the Law of One Price.[3]

The concept of a perfect market is frequently used in marketing research as a model against which to measure the efficiency or performance of actual situations. Bressler has stated: "To be most useful, marketing research should be oriented with reference to some concept of an ideal or perfect market."[4] He suggests that the most useful concept to use is one which would characterize the results of an economy of perfect competition.

It is the application of this standard to retail prices of chicken meat found in a sample of retail stores in the Los Angeles market[5] which gave rise to consideration of the hypothesis developed in this paper. One of the most noticeable characteristics of the retail prices studied by the authors was their wide variation among different stores. This variation persisted even when prices were compared among stores offering the same type of service, in the same location, and for practically identical products. This variation was particularly noticeable in view of the almost unanimous opinion of economists and others that the level of competition *among food stores* in the Los Angeles market is quite high. Two questions immediately arose: (1) What significance do these price variations have for assessing the level of competition? and (2) Why do prices vary by

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[2] *Principles of Economics*, 8th Edition, The Macmillan Company, New York, Book V, p. 328, footnote 2.

[3] "Within a given market, under conditions of pure and perfect competition, only one price can exist for a given commodity of a given quality at a given time." F. L. Thomsen, *Agricultural Marketing*, New York, McGraw-Hill Book Co., 1951, p. 87.

[4] R. G. Bressler, Jr., "Agricultural Marketing Research," *This Journal*, Vol. XXXI, No. 1, Part 2, February, 1949, p. 552.

[5] "Some Economic Aspects of Retailing Chicken Meat," by Kenneth D. Naden and George A. Jackson, Jr., Report of the Western Regional Poultry Marketing Committee, WM-7, California Agricultural Experiment Station Bulletin (in press).

different amounts in the different markets through which a commodity passes? This led to the development of the requirements for perfect competition at retail.

The requirements for perfect competition have been given as follows:[6] (1) each economic unit is so small relative to the market that it exerts no perceptible influence on the prices of things it busy and sells; (2) prices and the mobility of resources are not restricted; and (3) all economic units possess complete information. Presumably these conditions apply to markets at all levels of the marketing channel. These conditions will result in price uniformity among outlets. However, the degree and extent to which they can exist are widely different at each level of marketing for any particular commodity.

One of the reasons for this is that the scope of the concept "price" is different in different types of markets. In a single-product market, price can usually be taken to include only the one product involved. Uniformity of price among outlets for that commodity would tend to occur insofar as the requirements for competition are met. Many wholesale markets for farm products have a high degree of competition. In multiple-product markets, "price" may refer either to an individual item on the grocer's shelf or to the composite price of all the goods he sells. Institutional conditions limiting competition at retail apply much more forcibly to individual items than to the sum of all the items offered by a store. The situation found among retail food stores in the Los Angeles market, which is described here, was that prices for an item varied widely among stores, but prices for the entire market basket offered by most stores of the same type were quite uniform. It is our purpose to show how institutional factors enter into the pricing of individual products in retail stores and create a complicated monopolistic and imperfectly competitive environment.

Among the factors considered are changes in food retailing, social custom, immobilities, imperfect knowledge, joint demand, and imperfect imputation of retailing costs.

Institutional Factors

Growth of the super market—One of the outstanding changes in food retailing in the past twenty years has been the growing popularity of the super market as a retail store outlet. The number of stores in the United States classed as super markets has risen from practically none in 1930 to over 13,000 in 1949. The volume of business done by these stores in 1949 was about twenty-nine per cent of the total of all food sales.[7] The

[6] George J. Stigler, *The Theory of Price*, The Macmillan Company, New York, 1946, p. 21.

[7] *Food Marketing*, edited by Paul Sayres; McGraw-Hill Book Co., New York, 1950, p. 41.

main feature accounting for the popularity of the super market was the "one-stop" shopping feature. Super markets offered a wider variety of food items and more brands of each than in the traditional smaller store. An additional feature was the low price which generally prevailed due to the large volume of business and the economies of vertical integration.

These features offered shoppers the opportunity to buy food items less frequently and in larger quantities on each visit to the store. This had the effect of concentrating food purchases in one store.[8] Such concentration focuses the attention of the shopper on the whole package or aggregate of goods and services offered by each store rather than on each individual product.

The importance of a large number of items in super markets is illustrated by the growth of non-food lines carried by super market food stores. According to a mailed questionnaire survey by the magazine *Super Market Merchandising* in 1947, thirty-nine non-food lines were carried by more than half the super markets contacted. Most of the respondents planned to add more lines.[9]

Growth in number of automobiles—Coincidentally with the rise in popularity of the super market came an increase in number of automobiles. Shoppers at super markets usually use an automobile because of the larger size of the order with more infrequent buying. Most super markets recognize the need for using an automobile by their customers and arrange to have parking facilities available. One of the effects of this trend toward more automobile shopping is to concentrate attention on getting all the household items at one stop and increases the intensity of competition among stores which are now more easily reached by using the automobile.

Joint demand for food products—The fact that the total utility to any individual can usually be raised by purchasing most of his food requirements in one rather than several stores reveals a "jointness in demand"[10]

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[8] "How We Shop for Groceries," Food Staff Presentation No. 14, Batten, Barton, Durstine, and Osborne Advertising Agency, New York, 1950. This study of shopping habits of housewives showed that 69 per cent of the correspondents visited only one store in buying their "big" weekly order of groceries.

[9] Richard M. Alt, "Competition Among Types of Retailers in Selling the Same Commodity," *Journal of Marketing*, Vol. XIV: 3, October, 1949, p. 443.

[10] The question has risen as to whether an increase in utility which creates the incentive to buy many items at one store is a true case of joint demand. Joint demand is a term used to explain the increased utility which accompanies the use or consumption of two or more goods together rather than separately. It is a reflection of the complementarity of two or more goods. Joint demand is defined as a situation in which "an increase in the purchase of Good A results in an increase in demand for Good B." An extreme case of complementarity is represented by the demand for right-foot and left-foot shoes. However, the dgree of complementarity may be lower and based on habit—such as that for bacon and eggs—rather than upon physical necessity. If it can

for food items which is significant to this problem. The significance lies in the fact that joint demand for many food items is a strong factor in shifting the attention of shoppers from individual commodities to the aggregate offered by a store.

The joint demand existing in purchasing many goods together rather than separately can be shown as follows. Assume Good A is offered only in Store 1 and Goods A and B are offered in Store 2. A shopper must have Good B so goes to Store 2 to get it. He also wants Good A and has an incentive to buy it in Store 2 simply because of the spatial disutility involved in traveling to Store 1 to get it. Now assume that Good A is lower priced in Store 1 than in Store 2. The shopper now has a money value to weigh against the disutility of traveling to the second store. The amount of the price difference in an item between the two stores which can be maintained before causing the shopper to shift to Store 1 to get the lower priced good is a measure of the degree of complementarity and joint demand existing for these two goods. If consumers have less than full information about prices and quality of the many goods offered in different stores, the size of the price difference can be larger and can be maintained longer without loss of patronage. This explains that lack of full information can be and probably is an important cause of price variations for identical commodities among different outlets. But even with full information, joint demand constitutes an incentive to shoppers to concentrate their shopping and thereby shift their attention from individual commodities to the aggregate of goods offered.

Retail Price Policies

The conditions described in the preceding paragraphs permit retailers to develop an individual price policy for each store. This price policy operates at two levels—that of the aggregate of goods offered by the entire store, and that of individual commodities. At the store level, the minimum goal of the price policy is to yield an overall margin sufficient to keep the retailer in business. At the same time, another goal is to maximize profits by maintaining an over-all level of prices which is lower than his competitors in the same location offering approximately the same quality and variety of goods and the same service.

The type of price policy which can be developed when the major emphasis of shoppers is on the aggregate of goods offered gives a store manager considerable opportunity to experiment, to adapt his prices to situations as they develop. The store manager may use discriminatory prices when desirable; he may price different cuts of meat so they move

be shown that two or more goods of any kind are bought together because the utility to the shopper is increased by buying them together rather than separately, then joint demand exists.

with the proper speed; he may meet particular kinds of competition when they arise. Under this type of a price policy the products selected in each store for a high or a low markup may vary widely from store to store. Professor Alt has stated:

> There is no reason why any one item need be sold at any markup above that necessary to cover direct costs. In many cases merchants find it desirable to sell certain items at a short markup because they derive thereby a contribution to net revenues over and above direct costs, which contribution might otherwise be entirely lacking.[11]

Within the foregoing framework of pricing policies, there are many additional reasons and opportunities for variations in prices of individual commodities to arise. One important reason is the inability of retailers accurately to allocate costs of operation to the commodity to which they pertain. The use of a single principle such as floor space occupied or contribution to total sales is not applicable to all commodities since there is wide variation in value in proportion to bulk, in labor requirements, and in perishability of different goods. The result of this variation is that some goods are overpriced and some are underpriced, as compared to what they would be if they were the only product handled. Smith has commented on this situation in these words:

> The imperfect imputation of retail selling costs means that while the average of all prices covers the costs of the retailer, the consumer who buys goods of one kind will tend to subsidize (or be subsidized by) the consumer whose tastes lie in a slightly different direction. This result is not likely to be serious in a perfect market, although it is interesting to note that it can exist.[12]

The widespread use of loss leaders and price specials on weekends for certain items creates an opportunity for wide variation in prices among different outlets. The use of a loss leader in retail stores is based on the premise that shoppers attracted by the great saving in one item will come into the store and buy other items also. In this way the store will be able to recoup the losses on one item by profits on others. Since the items selected by each store for loss leaders or for advertising effort depend upon many factors (supply on hand, perishability, buying practices, size of operation, etc.), it follows that the price of any one item will differ among stores.

Custom and habit regarding high-margin and low-margin items may also cause price variations among stores to arise. For instance, one store may have established the principle of applying a uniform percentage markup to all cuts of meat except those considered as a "price special." Another may have the practice of applying one percentage markup to low-priced items and a higher percentage markup to high-priced items.

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[11] Alt, *op. cit.*, p. 443.

[12] Henry Smith, *Retail Distribution*, London, Oxford University Press, 1937, p. 29.

This is a form of discrimination which can be applied if the demand curves for these cuts among the patrons of this store are different. The success of such a practice will depend somewhat on the income classes of patrons or their personal tastes. Once such practices become established in a store they are likely to remain in effect, thereby contributing to the price variation among stores. The persistence of such customs is a reflection of the fact that the price differences caused by the custom are not of sufficient size to overcome the disutility of getting the item at the store where its price is the lowest. It may be stated again that ignorance of price and quality differences among stores may be responsible for some of the price differences which occur. But it is also true that with full information, price differences caused by the factors mentioned above could persist.

Retail Chicken Prices

During 1949 and 1950, the authors investigated several aspects of retailing chicken meat in the Los Angeles market.[13] Data were collected from a stratified random sample of the retail food stores in the entire market. Price data were collected by personal observation of all fresh and frozen chicken displays during biweekly visits to the sixty-four stores in the sample. Price observations were made on the same day each week so that daily changes did not affect the results.

Both before and after taking account of differences in price due to differences in quality (all displays were graded by USDA standards), a notable characteristic of the prices of each class and form of chicken meat was their wide variation among stores (when compared to the standard of a single price usually expected under perfect competition). The retail chicken prices presented in this section illustrate the hypothesis of this paper and are consistent with it.

The variations in retail prices were greater for the high-priced items than for the low-priced, and greater for the fresh chicken products than for the frozen type (Table 1). The typical standard deviation about the average price of dressed fryers (the product of greatest volume) was eight cents per pound. For this product a range of sixteen cents per pound remained in effect most of the time and occasionally the difference between the highest and the lowest price was thirty cents per pound.

It should be noted that price variations of this order remained in effect for the entire year of the study even though average of weekly data for only five months are shown in Table 1. Thus the variation in data shown was not changing upward or downward but was a permanent characteristic of the retail market for these products. These variations remained in effect without significant trends in volume of sales developing. In other

[13] Naden and Jackson, *Op. cit.*

TABLE 1. AVERAGE OF WEEKLY RETAIL PRICES AND STANDARD DEVIATION, CHICKEN MEAT PRODUCTS, ALL GRADES AND BRANDS, LOS ANGELES MARKET, JUNE–OCTOBER, 1950

Product	Cents per Pound
Fresh dressed:	
Fryers	59±8
Roasters	65±9
Heavy hens	51±8
Light hens	41±4
Fresh, Ready-to-cook:	
Fryers	78±7
Roasters	82±10
Hens	62±6
Frozen, Ready-to-cook:	
Fryers	86±7
Roasters	86±10
Hens	78±8

words, the stores in the sample which typically charged high prices for chicken were not losing volume of chicken sales during this period, nor were the stores typically charging low prices gaining volume of sales. Wide variations in weekly volume of sales did occur during this period, but they were due to temporary use of merchandising and promotional activities in the week of occurrence.

The wide price variations at retail were in marked contrast to the price variations found at wholesale in the city. The Market News Service daily price report and many contacts with the processors and wholesalers reveal that the range in prices charged retailers for dressed chicken of any class was about four cents per pound. This variation was due partly to variations in quality, but mainly to variations in non-price factors such as credit reputation of the buyer, volume purchased, bargaining power, past favors received, etc. The wholesale market for fresh chicken has a reputation for being intensely price conscious.

The price variations shown in Table 1 were gross variations. They were due partly to differences in services offered by stores, partly to differences in size and type of store, and partly to differences in location as measured by rental paid in the area. These factors are the most obvious causes for differences in cost of store operation which might be reflected in price differences. After taking account of these cost factors, a wide range in prices among stores for each product remained. This remaining variation is attributable partly to lack of information and partly to immobility of consumers, but primarily to the conscious application of price policy by retailers. This price policy is possible because of the cost and disutility to consumers of minimizing the cash cost of their food requirements with the result that they concentrate their purchases of food in one or a few stores.

TABLE 2. AVERAGE OF WEEKLY PRICES AND THEIR STANDARD DEVIATION FOR CHICKEN MEAT PRODUCTS, BY SIZE AND TYPE OF STORE, LOS ANGELES MARKET, JANUARY–MARCH, 1950

	Super Markets		A Size		B Size	C Size
	Chain	Indep.	Chain	Indep.	Indep.	Indep.
			(cents per pound)			
Fresh Dressed:						
Fryers	54±6	55±7	—	59±9	56±6	59±2
Heavy hens	47±6	49±9	—	50±8	50±6	53±5
Light hens	36±4	37±5	—	40±5	41±*	42±*
Frozen, Cut-up:						
Fryers	77±4	81±6	67±*	81±6	81±5	82±5
Hens	72±5	76±7	65±*	76±8	75±*	84±8

* Indicates only three or less displays of this product carried in sample stores.

Prices by size and type of store—Table 2 shows that when the sample stores were classified according to size (measured by gross sales) and type (whether chain or independent), price variations for each class and form of chicken meat remained high. Part of this price variation was caused by differences in quality of chicken carried by each store. An examination of the price-quality relationship existing in the city for these

TABLE 3. AVERAGE OF WEEKLY RETAIL PRICES AND THEIR STANDARD DEVIATION FOR CHICKEN MEAT PRODUCTS, BY RENTAL AREAS, SELECTED WEEKS, LOS ANGELES MARKET, 1950

Classes of Chicken	Rental Areas		
	Upper	Medium	Lower
		cents per pound	
Fresh Dressed:			
Fryers	64±5	59±6	57±7
Heavy hens	54±10	47±5	47±6
Light hens	—	40±4	39±4
Fresh, cut-up:			
Fryers	83±3	78±6	75±5
Frozen, cut-up:			
Fryers	84±6	83±7	86±4

products showed that on the average, Grade A products sold for one to four cents per pound over Grade B products. However, there was such a wide variation and overlapping in prices for each grade that the influence of quality on the prices in Table 2 is not considered significant.

Prices in different rental areas—Another factor to be considered in explaining the price variations in Table 1 is rental or income area in which the store is located. Table 3 shows the price variations existing for each chicken product after grouping the sample stores according to the income

area in which each was located.[14] The data show a wide range in prices exists. Since the different sizes and types of stores were distributed quite evenly throughout each income area, a further classification of prices by different sizes and type stores within each income area was not necessary.

Some of the stores in the high income area were definitely service- and quality-conscious in their operations. They usually offered credit and delivery service, telephone order service, and clerk service. As a result, prices of all products in these stores were above average. The effect of quality differences on the prices shown in Table 3 is small because stores in each income area carried about the same quality of chicken.

The primary importance of these three tables is that no matter how the prices of each chicken meat product were classified, a large variation occurred. A small portion of this variation is caused by differences in service offered, in quality of product, in size and type of store. The largest portion is caused by lack of knowledge of shoppers and by the conscious application of price policy by each retail store manager.

Implications

For Retailers—1. Under modern retailing conditions, where the focus of competition is shifting from each item to the aggregate of items offered by a store, the price of each item is more related to the demand for it than to its cost. Pricing is something of an art. There are few rules or principles available as a guide. It has been stated this way:

> Pricing is part of the art of merchandising. The most successful practitioners of this art usually find it difficult to formalize their thinking on price-making because intuitive judgment bulk large in pricing decisions. Moreover, the economic and psychological variables that influence a decision vary with the item and the particular conditions under which it must be sold.[15]

2. Profit maximization for the entire store becomes a complex matter. In view of the large number of variables making up the general appeal or drawing power of a store, the retailer faces this mathematical problem: how to maximize the over-all appeal of his store subject to the constraint that the total cost of a market basket of food of a given quality in his store has to be substantially identical (or give the appearance of identity) as the cost of the same market basket of food in closely competing stores. The effect of location and service stratification probably reduces the number of close competitors to a low figure. In making the above calculation, each item of appeal in the entire store has to be scrutinized to see if it can be reduced in order to reduce the cost of the basket of food and at

[14] The market which was included by this study was divided into three income areas according to average rental paid in 1940 (data from Census of Housing).

[15] "Some Principles of Department Store Pricing," by Q. Forrest Walker, *Journal of Marketing*, Vol. XIV, January, 1950, p. 529.

the same time to see if it can be increased in order to improve the appeal or standing of the entire store. Each aspect has to meet the following marginal analysis: new products and services will be added up to the point where the addition to total returns to the store of the aggregate is equal to the increase in cost which it impels. The difficulty and complexity of this calculation is immediately apparent.

3. The most profitable method of competing is to get shoppers into the store and convince them to return. The majority of shoppers buy most of their food needs in a single store.[16] Once inside the store, they are to some extent, a captive audience. The question immediately arises as to which aspects or items of appeal are most decisive in getting shoppers attached to a store.[17] Each store cannot be all things to all shoppers. It is probable that each shopper cannot comprehend and compare, even among a few stores, all the factors of appeal which have been considered here. One shopper may be vividly aware and conscious of prices, for instance, but be indifferent to store atmosphere. Another shopper may stress the variety of goods displayed, but still another shopper may be drawn by the general quality of goods offered. It is these variations in personality of shoppers which impart some of the high risk to retailing.

4. More competition is in terms of comparison of different items within the same store than in the comparison of the same item in different stores. This follows from the increasing emphasis being placed on one-stop shopping. This means that promotional efforts to increase sales of one or a small group of items in a store will be compensated for by decreases in

[16] S. C. Shull, and M. R. Godwin, "Consumer Shopping Habits," Extension Bulletin No. 137, University of Maryland, College Park, June, 1950.

[17] The primary factors which affect consumers' decisions about the store to be visited are well known, but there is argument as to the relative importance of each. A study made by the California Consumers Relations Company (Reported in *Western Family Preview*, Spartan Edition, Vol. 20, No. 16, July 20, 1951, p. 16) showed the following distribution of reasons why a sample of consumers selected their favorite store:

Fair Prices	19.4%
Close to home	14.7%
Variety of selection	13.9%
Courtesy-friendliness	13.9%
Quality merchandise	10.1%
Fresh produce	9.9%
Good meats	7.8%
Cleanliness	5.2%
Other (parking, fast checkers, service, etc.)	5.1%

Another study (Shull and Godwin, *op. cit.*, pp. 5-7) showed that consumers rate these factors differently according to the class of food product under consideration. For instance, out of a sample of medium-income housewives in Baltimore in 1948, the factor of quality was listed as most important in their selection of a store for meats, the factor of convenience was rated highest in their selection of a store for canned foods and fruits and vegetables. The factor of quality was rated only fourth in importance in selection of a store for canned goods, but second in importance in selection of a store for fruits and vegetables.

sales of other products unless the promotional efforts serve to increase the purchases of regular customers or to bring new customers into the store.

For Marketing Research—A number of problems and significant issues are raised immediately by the hypothesis that the main focus of competition in the food retailing business is at the level of the whole store rather than at the level of each individual product. Among these are:

1. The commodity approach to marketing research may be less useful than other methods of study. The reason for this is that after a commodity leaves the wholesaler, it loses much of its identity and becomes part of a package of goods and services. The commodity approach to marketing research follows a single commodity or group of related commodities from the producer to the consumer, analyzing the competition, costs of marketing, and relation to other commodities at each level. If a commodity loses its identity at the retail level, this approach has then lost some of its value.

2. Less emphasis should be placed on prices or margins of individual commodities as a measure of the level of competition at retail. Since prices among stores cannot be directly compared, some measure of the competition of whole store would be most useful. Such a measure would necessarily contain many non-price items such as location, services offered, variety of goods carried, and many other factors. Since many items like this cannot be directly compared, a measure such as profit rate on all items carried may be more satisfactory.

3. The use of the term "retail market" for individual commodities needs to be reconsidered. A market is any group of buyers and sellers who are in close communication with each other. If these buyers and sellers at retail do not concern themselves with individual commodities but primarily with an aggregate of goods and services, the question arises as to whether this is a truly retail market for a single product.

4. The reporting of retail prices for individual commodities in Market News Service reports would appear to be inadequate for determining what producers of that commodity should get. Many producers feel that the publication of retail prices for their commodities is information they can use in bargaining purposes. In a perfect market they should receive the retail price of a commodity less marketing costs. However, if institutional factors make high competition for individual items impossible, then producers should pay attention to competition in wholesale markets. Under modern conditions of retailing, the price paid for an individual commodity by consumers is not a guide as to whether the general price level for that commodity has changed, and therefore, whether more or less money for the producer is warranted.[18]

[18] For a statement of the viewpoint that retail margins of individual commodities should be closely related to retail costs for each commodity, see "Retail Market News as an Aid to Marketing," by K. J. McCallister, F. J. Poats, and Mary Winston Jones,

Summary

It is the hypothesis of this article that price variations between identical items in retail food stores, which are closely related in the overall sense, are not inconsistent with a high level of competition for the store as a whole. The main reason for this is that a number of institutional factors restrict the expression of a high level of competition for individual items much more than for the aggregate of goods offered by a store. These factors such as immobility, social custom, absence of information, and other inconvenience costs serve to concentrate attention on the entire group of items as well as on individual items. By concentrating their purchases, the majority of consumers show that they prefer not to minimize cash costs of the family food requirements because of the effort and trouble of shopping most "efficiently." Professor Grether has stated:

> Consumers, even when relatively well-informed, and thoroughly aware of the nature of the difficulties involved in efficient purchasing, may rationally prefer to pay a premium in order to obtain greater leisure or to offset the sheer effort and irksomeness of careful shopping, of making comparisons of prices and qualities, and of collecting and interpreting evidence to guide choice between commodities and vendors.[19]

Additional important reasons for the price variations found were the imperfect imputation of costs and the freedom of retailers to use their imagination and skill in exploiting demand for the many different products they carry.

The main significance of this hypothesis for retailers is that they should focus their attention on the overall appeal of the entire offerings of their store as well as on individual items. The main significance for marketing research is that since buyers and sellers at retail do not think or operate exclusively in terms of individual commodities but to a large extent in terms of an aggregate of goods and services, it appears that the ordinary concept of a retail market for any *single product* has to be reconsidered.

Marketing Research Report No. 19, Production and Marketing Administration, USDA, May, 1952, p. 3-11.

[19] E. T. Grether, *Price Control Under Fair Trade Legislation,* New York, Oxford University Press, 1939, pp. 227-228.

FIFTY YEARS OF FARM RECORDS IN MINNESOTA

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FARM management research in the United States has passed its fiftieth milestone. On January 1, 1902 W. M. Hays and Andrew Boss started some cost accounts on Minnesota farms. This was the first organized continuing project in farm management research in the United States. It was also the first research project in the general field of agricultural economics in this country.

Early interest in farm management and the events leading up to the inauguration of organized research work in the field have been ably reviewed in earlier numbers of *This Journal* by Warren[1] and Boss.[2] This article will serve to supply some additional details of that history. It will be confined to the development of farm records as a research tool in a single state, pointing out the development and evolution of farm records as a source of basic data for farm management research over the past half century. It is written with the thought that a knowledge of past experience may prove a useful guide to workers now developing programs of farm management research. It is also the hope of the author that other readers of *This Journal*, familiar with the history of farm records as a source of research data in other states, may be induced to contribute their observations and experiences as a basis for a more comprehensive appraisal of the place and most effective use of farm records in farm management research methodolgy.

The early cost accounts at Minnesota represent the beginnings of an economic study of farm management that has been in continuous operation ever since. It has not only formed the basis and backbone of the farm management research program in the Minnesota Agricultural Experiment Station, but has served as a pattern for similar studies elsewhere. The author wishes to outline the development and evolution of methodology in record keeping and analysis that has occurred, in this institution, to point out changes in the results secured and in methods of presenting them, and to make some general appraisal of the adaptations and limitations of the program.

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[1] G. F. Warren, "The Origin and Development of Farm Economics in the United States." *This Journal.* January 1932. pp. 2-9.

[2] Andrew Boss, "Forty Years of Farm Cost Accounting Records." *This Journal.* February 1945. pp. 1-17.

Early Beginnings in Farm Record Research

The cost accounting studies in Minnesota grew out of the interest of Hays and Boss, both agronomists, in crop rotations and their contribution to profits. This turned their attention to cost figures. Back in the nineties they had the dream of getting such cost figures from their experimental plots but after a trial, soon realized that costs, to be of any value, had to be based on actual farm operations. To get this information these investigators first had to sell the idea to farmers in selected communities. This they did so well that on January 1, 1902 groups of farmers in three type-of-farming areas in the state began supplying information to a fieldman who made daily visits to each farm. During the first two years attention was centered on crop costs. Complete labor records were obtained but no effort was made to allocate feed or other livestock costs.

It soon became evident that crops records were inadequate for a full analysis of the farm business, so the records were broadened to include complete detailed records covering crops, livestock, personal, and household, as well as farm, financial records. This necessitated cutting the number of records one fieldman could supervise from 15 to 8. During the first two years, the fieldman obtained all the information directly from the farmer and posted and summarized it. With the expansion in 1904, he still visited each farm every day but sent his material to a central office at the Experiment Station to be posted and summarized. Arrangements were made to have the farmer keep his own financial and personal records. To induce him to do this it was necessary to pay him a small fee for his services.

Widening the Scope of the Work

As time went on, the farmers came to realize the value of the information obtained from their records. They were not only willing to forego remuneration for their part in supplying the information involved, but they were willing to keep most of the original records themselves. This made it possible for the fieldman to cut down the frequency of his visits and to cover more farms. The number of farms per fieldman was increased up to 25 or 30. In 1951 a part-time fieldman not only handled the field work for 33 farms but also did much of the office work on the records. Another change was in the number of years covered by a record project. In one of the three original areas, records were continued for sixteen years, in another eleven years, and in the third, nine years. Funds were not available to cover all important type-of-farming areas in the state with record projects. It was therefore decided to cut down the period that detailed or cost accounting records were kept in any area and rotate them about the state. By shortening the number of years of continuous records

in any one area to a period of from three to five years, it has been possible to secure a better balanced supply of farm management research information for the state as a whole.

Another change, designed to increase the numbers covered by a farm record project and reduce the cost per farm, was made in 1928. A group of dairy farmers in southeastern Minnesota agreed to keep their own records with only occasional help and guidance from a fieldman. It was necessary to eliminate some detail to ease the burden on the farmer as well as to simplify office analysis. Labor records were dropped, and the individual farms were no longer mapped each year. This proved so satisfactory that by 1930 the number of farms in this study had increased to 180. The withdrawal of federal funds from this expanded study at the end of 1930 threatened its discontinuance. However by this time the farmers had found the records and the analysis based on them so valuable that they subscribed the funds for their continuance. This study is now in its twenty-fifth year with the farmers paying the major share of the cost. A similar cooperative record service, set up in southwestern Minnesota in 1940, is also in operation. The average annual fee paid by these groups varies from $45 to $50 per farm. These cooperative studies are mutually beneficial in that they provide the farmer and the experiment station wtih vital facts about the farm business at less cost than either could secure alone. The cost to the experiment station is no greater and probably somewhat less than that of obtaining the same quantity and quality of information by the survey method.

Another variation was introduced in 1931 to simplify the record keeping and analysis and to make it possible to cover more farms with less super-

TABLE I. FARM RECORDS USED FOR RESEARCH PURPOSES PER YEAR AND TOTAL BY PERIODS, 1902–1951

Years Covered	Regular Projects		Special Projects			Grand total
	Cost Accounts	Financial Accounts (with feed records)	Financial Accounts With feed records	Financial Accounts Without feed records	Total per year	
1902–03	45	—	—	—	45	90
1904–17	25	—	—	—	25	343
1918–19	0	—	—	—	—	0
1920–27	44	—	—	—	44	348
1928–30	23	159	—	—	182	546
1931–39	20	146	—	280	446	4,019
1940–45	19	234	—	197	450	3,300
1946	0	320	—	119	439	439
1947–50	0	321	378	—	699	2,796
1951	33	279	260	—	572	572
Average or total	24	113	35	77	249	12,453

vision and at less cost. Under this plan only part-time supervision was provided. Feed as well as labor records were eliminated. This plan supplied less detailed information, but it provided it at lower cost per farm and made it possible to include farmers with less ability as record keepers. This was used largely in special studies of short duration and covering specific problem situations.

A general summary of the farm records analyzed over the fifty year period is shown in Table 1. The three types of records, classified according to completeness, are shown separately: (1) detailed or cost accounts, (2) financial accounts with feed records, and (3) financial accounts without feed records. They are also classified into: (1) regular, continuing research studies and (2) special studies set up to study special situations and special problems of a more or less temporary nature. These latter include studies of such groups as beginning farmers, Rural Rehabilitation (now Farmers Home Administration) clients, and cooperators in soil conservation and T.V.A. phosphate demonstration projects. A total of 12,453 farm records were analyzed of which approximately 10% were detailed or cost account records. During the first twenty-six years only cost accounts were included. They were gradually relegated to a less important place in the farm record program and from 1946 through 1950 were eliminated entirely. However, the rapid and revolutionary changes in farm techniques, and especially in farm mechanization, that dominated the picture at that time rendered earlier labor, power, and machinery data obsolete. To provide the needed information, detailed labor reports were added to those records already being kept on a 10% sample of the farms included in the paid farm record projects in 1951. Thus the same information as available from the former cost account studies was secured at much lower cost since, as previously indicated, only part time field service was required, and the farmers served were bearing a substantial share of the cost.

Early Publications of Results

Changes in methods of analysis and in the amount and type of material published were even more numerous and more marked over the fifty year period than were changes in the type and organization of the record projects. The early publications were devoted primarily to the presentation of monetary costs of producing corps meticulously computed by operations down to the fraction of a cent per acre.[3, 4] No costs in physical terms were presented. Some attention was given to the use of the data

[3] W. M. Hays and E. C. Parker, *Cost of Producing Farm Products.* Minnesota Agr. Expt. Sta. Bul. 97. 1906.

[4] E. C. Parker and T. P. Cooper, *Cost of Producing Minnesota Farm Products, 1902-1907.* Minnesota Agr. Expt. Sta. Bul. 117. 1910.

presented in studying some of the management problems of a farmer. The second of these publications included a small amount of information on livestock costs including some physical input data.[4] In 1911, a bulletin on cost of producing dairy products was published.[5] In this there was considerable information on physical inputs and outputs in addition to monetary cost computations. Another crop cost bulletin of the same type as those mentioned above appeared in 1914.[6] Also, in 1916, two bulletins presenting in considerable detail labor requirements for crops and livestock and the seasonal distribution of this labor were published.[7, 8] The same year a study of the cost of living on the record keeping farms was published and in 1918 another bulletin on cost of crop production.[9, 10] This last mentioned crop cost study was similar to its predecessors except that the hours of man labor and of horse work were shown in physical quantities as well as in monetary terms. In the previous bulletins, man labor and horse work were combined into a single money item of labor cost. In all of these early publications the data presented were averages for the farms covered in any particular area and, usually, for the whole period of years covered by the study. No individual farm figures or ranges were shown.

Types of Analysis and Publications Change

A considerable shift in methods of analyzing and presenting the results of these farm record studies took place following 1920. Up to that time the farmers supplying the record data were given little analysis of their business, and the only form in which the public had access to the data was through the bulletins already mentioned. The emphasis shifted from monetary costs of production to physical quantities of goods and services used in the production of farm products. It is very difficult to make highly significant allocations of cost to individual enterprises and individual products. Furthermore, it is expensive and time consuming. Some approximate allocations of costs were still made, but the major emphasis was on the presentation of data needed for farm planning and for studying specific farm problems. In other words, data for advanced planning

[5] T. P. Cooper, *The Cost of Producing Minnesota Dairy Products, 1904-1909.* Minnesota Agr. Expt. Sta. Bul. 124. 1911.

[6] F. W. Peck, *Cost of Producing Minnesota Farm Products, 1908-1912.* Minnesota Agr. Expt. Sta. Bul. 145. 1914.

[7] T. P. Cooper, F. W. Peck, and A. Boss, *Labor Requirements of Crop Production.* Minnesota Agr. Expt. Bul. 157. 1916.

[8] A. Boss, F. W. Peck, and T. P. Cooper, *Labor Requirements on Livestock.* Minnesota Agr. Expt. Sta. Bul. 161. 1916.

[9] F. W. Peck, *Cost of Living on Minnesota Farms, 1905-1914.* Minnesota Agr. Expt. Sta. Bul. 162.

[10] F. W. Peck, *The Cost of Producing Minnesota Field Crops, 1913-1917.* Minnesota Agr. Expt. Sta. Bul. 179. 1918.

largely replaced historical cost allocations. Ranges of cost inputs rather than over-all averages were presented. More stress was placed on the farm business as a whole and less on breakdowns by enterprises. For the first time, earnings statements for the farms were published. These were presented in the form of ranges rather than merely as averages. Another change in publication policy was the shift to mimeographed reports issued each year instead of waiting to accumulate the data for a period of years. These reports provided a steady current flow of information for use by farmers in farm planning as well as for teaching and extension purposes and for general distribution. Not only was it possible to get out a much larger volume of data in this way, but it appeared promptly without waiting for several year's records to accumulate and then incurring the further delay involved in getting out a formal printed bulletin.

In the early twenties, the substitution method of farm budgeting was developed as a research tool to determine the most effective combination of resources for a given farm situation. This method had been in use in teaching work by Hays, Boss, and others for some twenty-five years, but the first publication in which its development as a research device appeared was in 1923.[11] This served as a pattern for a number of similar studies that followed and led to more stress on the presentation of farm record data in such a way as to be most useful for this type of analysis.

Another type of analysis was developed with the simpler type of records started in 1928. Attention was shifted to an analysis of the factors affecting financial success of the farm business as a whole, and of the individual enterprises making up the farm business. The factor analysis was developed, and the results were presented in a series of printed bulletins in addition to the annual reports.[12-16] Considerable attention was given to development and refinement of factor analysis as a research and extension tool. One interesting development of this project was a study of the human factor in farm management. Boss and others who had followed the farm records project closely became impressed with the fact that variations in farm income could not be wholly explained by variations in the farm and its organization. They reasoned that back of the farm lay

[11] G. A. Pond and G. W. Tapp, *A Study of Farm Organization in Southwestern Minnesota*. Minnesota Agr. Expt. Sta. Bul. 205. 1923.

[12] G. A. Pond, W. P. Ranney, and C. W. Crickman, *Factors Causing Variations in Earnings Among Dairy Farmers in Southeastern Minnesota*. Minnesota Agr. Expt. Sta. Bul. 314. 1934.

[13] T. R. Nodland and G. A. Pond, *Managing the Dairy Herd for Greater Profits*. Minnesota Agr. Expt. Sta. Bul. 378. 1944.

[14] T. R. Nodland and G. A. Pond, *Managing Hogs for Greater Returns*. Minnesota Agr. Expt. Sta. Bul. 379. 1944.

[15] T. R. Nodland and G. A. Pond, *Managing Sheep for Greater Returns*. Minnesota Agr. Expt. Sta. Bul. 382. 1945.

[16] G. A. Pond, *Why Farm Earnings Vary*. Minnesota Agr. Expt. Sta. Bul. 386. 1945.

the farmer and the farm family and their personal interests, aptitudes, and abilities. This pioneer study of the human factor brought out some very interesting and significant facts.[17] It points to a long neglected field in which a combined investigation by the farm management researcher and the psychologist, promises to be a valuable contribution to our knowledge of what makes a farm business click.

How the Results Were Presented and Used

The results of these fifty years of farm records have furnished the main source of information for 28 experiment station bulletins, 2 technical bulletins, 11 extension bulletins, 193 mimeographed reports (averaging 25 to 30 pages each), a number of circulars and pamphlets, and a steady flow of articles in farm papers and current releases from the Agricultural Experiment Station. They have supplied a continuous flow of information on farm costs, farm returns, and the factors affecting farm financial success. They have provided information and illustrations for both resident and extension teaching. They provide the only data available in the state on the personal and household expenses of farm families. The latter are especially useful in planning farm programs and appraising the debt servicing capacity of a given farm set-up. Of the thousands of farm management questions that come to the experiment station, there are few to which these records projects do not contribute at least a part of the answer. They have also a more general use in matters of agricultural policy and programs for the farmer. During World War II they supplied valuable basic information in setting production goals and quotas, and, more recently, in planning production programs and outlook statements for the state. In preparing the Minnesota section of the recent nation-wide study of Agriculture's Capacity to Produce they proved an exceedingly useful source of information.

Continuity of Objectives and Supervision

One significant feature of these fifty years of farm records was the high degree of continuity of direction and objectives that was maintained through the entire period. The project was primarily conceived in the versatile and highly imaginative mind of W. M. Hays and then translated into practical operation by the organizing genius of Andrew Boss. But Boss did not stop wth the organizational set-up; he continued in general charge as chief of the division in which the project was operated until 1928. From then to 1935, when he retired as vice-director of the Minnesota Agricultural Experiment Station, he still rendered valuable advice and

[17] W. W. Wilcox, A. Boss, and G. A. Pond, *Relations of Variations in the Human Factor to Financial Returns in Farming.* Minnesota Agr. Expt. Sta. Bul. 288. 1932.

suggestions to those in charge. Professor Boss was the major adviser in the undergraduate work and the early graduate work of O. B. Jesness who has been chief of the division in which the farm records studies were administered since 1928. The four men who successively had immediate charge of the record work all had their graduate and undergraduate training under Boss. These include E. C. Parker, later connected with the office of Grain and Forage Grading in the United States Department of Agriculture; T. P. Cooper who recently retired as Dean and Director of the Kentucky Agricultural College and Experiment Station; F. W. Peck, now managing director of the Farm Foundation; and the author of this article. Each of the last three served for several years as assistant to his predecessor before assuming charge himself. Through these fifty years continuous cooperation in farm record research was maintained with the United States Department of Agriculture–first through the Bureau of Statistics, later through the Office of Farm Management, and more recently, through the Bureau of Agricultural Economics. Of the importance of this continuity of direction and especially of the invaluable contributions of Andrew Boss, Henry C. Taylor in the late forties wrote as follows,

"As a forty-five-year undertaking, carried on by a succession of men in immediate charge of the work, the results are impressive. They stand without an equal in the United States. While there were many changes in personnel, both in Washington and in Minnesota, one man–Andrew Boss–was the guiding spirit throughout the period. To him must be given special credit for the stable, steadfast, unacclaimed progress of the work through the years. One by one he chose competent men to carry forward this undertaking. Those in immediate charge of the work were always close to Andrew Boss, who inspired them and steadied their gait. Boss worked with Willet M. Hays in planning and organizing the route method of gathering the facts from the farmers. Hays provided the vision and the driving force to begin the work; Boss' steady hand and persistent purposefulness carried it through, maintained the high quality, and kept it in line with the initial objectives while at the same time directing it toward the new goals coming ever into view with the progress of the work."[18]

Before attempting an appraisal of these fifty years of farm records it would be well to review the objectives as set forth in 1906 by Hays and Parker:

Summary of Objects and Results

Objects sought in collecting statistics of the business of farming

1. To aid in making a study of the business of the farm that it may be systematically conducted under the best possible plans.
2. To supply many averages which the farmer rarely secures from his own business, as cost per acre of various labor operations, and cost of producing field crop products and livestock products.
3. To determine the cost per hour of man labor and horse labor on farms.

[18] O. B. Jesness *et al. Andrew Boss, Pioneer and Builder.* Webb Publishing Co. 1950. page 71.

4. To determine the yearly values consumed in farm machinery, and the values consumed per acre for the various farm crops.
5. To collect data on the feeding of farm animals as actually carried out and make comparisons of methods.
6. To secure practical data concerning the profits from the different farm animals, and to devise simple methods of making records which will determine the value of each individual animal as a producer, and the breeding value of the blood of each animal used as a breeder.
7. To keep the performance records of dairy cows, and show reasons for profit and loss on the individual animals.
8. To secure the data necessary to supplement the records of experiments in crop rotation made by experiment stations, that the net profits from the various rotations may be compared.
9. To determine and compare the net profits in various systems of present day agriculture.
10. To assist the farmer to so organize his business that such arrangement of crops and livestock may be made as will give the largest net returns.
11. To collect maps of actual surveys from many farms to be used in working out examples of reorganized field plans with systematic crop rotations.
12. To assist in inaugurating simple systems of accounts for the farm business and the farm household.
13. To secure data concerning the farm home, as the cost of living, the value of foods grown on the farm, and the cost of boarding hired help.
14. To provide practical data to be used in schools, as consolidated rural schools, agricultural high schools, and agricultural colleges, in teaching the facts and principles of farm management.
15. To aid in developing a literature on farm management, and a class of effective teachers, editors, and general writers; and to assist in overcoming the indifference to antiquated methods in farm management.[3]

Such an ambitious and comprehensive list of objectives at this early date is quite surprising, especially in view of the limited scope of material in the early publication. However, as time went on and methodology developed most of the dreams of these early visionaries came true.

Limitations of Farm Record Studies

The discussion thus far may give the impression that the farm record studies as described constituted the entire program of farm management research in Minnesota. They were, however, supplemented from time to time with farm business analysis and enterprise surveys, enterprise accounts and other types of studies. Still, farm records probably play a more important role in this farm management research program than in any other state with the possible exception of Illinois. One of the limitations of farm record studies is the difficulty of getting a cross section or random sample of any group of farmers. The selection is based at least in part on the willingness of the individual farmer to keep records. This in turn tends to weight the study with a disproportionate share of more progressive and more successful farmers, and usually with those on larger farms

and who are more amply financed. The very fact that these men have their records and the advice and counsel of the fieldman results in most cases in improved management and increased earnings from year to year. Even though they may have been of only average or moderate ability when selected they are not likely to remain that way. In the detailed or cost accounting studies this is not serious since they are primarily case studies. In the less detailed accounting studies this selective factor is not as disturbing as might first seem since there is usually a sufficiently wide range of size, quality, practices, and managerial ability to make possible a useful analysis. After all the researcher is primarily concerned in determining good organization, good practices, and successful management. By using survey, census and other data it is possible to orient the accounting study within the universe studied.

Farm records have another possible disadvantage in that the representativeness of the situation to be studied cannot be determined in advance. In contrast a farm survey is not started until the production period is complete and some appraisal of its representativeness made. One of the detailed accounting studies was started in west central Minnesota in 1932. The first year drouth reduced crop yields to two-thirds of normal, the next year they dropped to less than one-half of normal, and a practically complete crop failure in 1934 made it necessary to discontinue the detailed records. The data secured were of very limited value. This type of loss, however, occurred only once in a fifty-year period, and in most of the farm record studies three years would have been ample to give a representative picture as far as weather conditions were concerned.

The repetitive nature of a farm record study always carries with it the threat of becoming routine and stereotyped. It is easy to become lost in the mass of detail and to grind out mere figures rather than useful, timely, and significant facts that will serve the farmer. The increasing interest of farmers in the results of these records studies and their willingness to keep records and contribute to the cost of their analysis is rather eloquent testimony to the fact that it is possible to keep a records project on a productive basis. The widely increasing uses for record data is further evidence that the error of monotonous routine can be successfully avoided.

A Balance between Empirical and Philosophical Approach

One final observation regarding these fifty years of farm records should be made. If monotonous routine recording is to be avoided and significant results are to be achieved, there must be a balance between the empirical and the philosophical approach. This farm record research at Minnesota was initiated by agronomists who recognized the value of sound factual evidence, but they also realized the place of abstract reasoning in planning their research and analyzing their results. They transplanted into a

new field the method of science that they had already successfully applied in plant science. As time went on, economic philosophy became increasingly valuable in setting up the hypothesis to be tested in farm record research and in analyzing the mass of data assembled. The bewildering rapidity with which changes in the national economy and the techniques of agriculture have been occurring makes it imperative that factual data be available to record these changes currently and to serve as a basis for guiding the farmer to adjust his operations as quickly and accurately as possible to these changes. Farming is a highly dynamic business and demands a dynamic approach to its economic problems. The farm management worker cannot hide away in his "ivory tower" and philosophize about the farmer's problems. He must keep abreast of the thinking of the farmer and of the kaleidoscopic changes that are occurring in farm technique. A continuing and close contact with key groups of farmers through a continuing farm record project is one of the most effective ways of accomplishing this.

FULLER USAGE OF PUNCH-CARD EQUIPMENT IN SOCIAL SCIENCE RESEARCH THROUGH IMPROVING TECHNIQUES

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THIS paper is primarily concerned with methodology in the use of IBM equipment especially adaptable to social science research. No attempt is made at completeness of treatment. Rather, the discussion is in the nature of a preview. Detailed treatment on specific phases of punch-card techniques will appear in a later series of papers.

The methodology described has been developed largely through "trial and error." Procedures recommended, in most instances, have evolved from application of practices now discarded as inadequate and outmoded. In an age of mechanization, IBM offers the "machine way" to research workers. Of concern in the matter of whether or not to adopt the punch-card method is the question of how far machine operations may be substituted for hand work. In the main this involves three factors: (1) techniques to facilitate the transferring of data and coded information from schedules to punch cards; (2) methods of preparing and handling of coding in all its aspects and applications; and (3) procedures insuring the most direct and complete machine sorts and tabulations.

Fuller Utilization of IBM Equipment

The degree to which IBM machines may be useful in processing research data and information depends in large measure on the type of equipment available. If the installation be confined to the simplest type of key punch, sorter and tabulator, IBM operations are restricted. If these machines be of the more advanced type and supplemented by such machines as a collator and a reproducing punch, the scope of IBM operations is greatly expanded.

The type of installation, however, is but one factor in full usage. The skill, resourcefulness, and expertness of the machine operator are of paramount importance. For a number of years the Texas Agricultural Experiment Station employed operators who received only a scant 10-day training. Such operators gain little beyond the mere rudiments of techniques and are in no position to utilize the full possibilities of the IBM machines. Best usage is dependent on other factors than ability to wire the boards and handle the controls. Furthermore, such operators are not qualified to assist the research worker in developing a program of full usage. The progress in better usage at the Texas Station during the past 4 years was

the direct result of the employment of a highly competent machine operator.

The director of the statistical laboratory must have a complete grasp of the potentialities of the various IBM machines. His stock in trade is a knowledge of how the machines operate. But the reseacher must have a general understanding of what the IBM equipment can do. Under no circumstance must he assume that with the installation of IBM machines, his role becomes that of mere schedule taker. The research worker and the machine operator must function as a team. This feature cannot be over-emphasized. Best results depend on teamwork in designing schedules and punch cards and in planning sorts and tabulations.

Type of Material Adaptable to IBM Processing

The potential user of IBM equipment should be concerned as to the type of material adaptable to punch-card procedures. In general terms anything expressible in figures or in code is suitable. As for data, the number of items in each category, or the size of population, the diversity of items, and the diversity of variables are all significant. IBM machines gain in usefulness as the population increases and as diversity of items and variables broadens.

Questions to which responses can be indicated by check marks in coded areas are especially well fitted to punch-card analysis. Coded check items can readily be handled through the use of a counting sorter. This analysis is greatly aided if a full set of tables be prepared beforehand for recording all sorter counts. Open, or free, response items are also suitable for punch cards provided a pattern of recurring responses obtains. Such recurring responses can be coded and handled as check items.

Preparation of Schedules

Best usage of IBM facilities starts with the schedule. It is highly desirable to handle data, check items, and open response items in separate schedules and in separate punch-card decks. Occasionally in the early use of IBM machines a printed card is designed for both the recording of the data and the punching of the data in the same card. It seems that the printed card disposes of much of the mystery of the punched card. Also the data written into the card attain a most desirable ideal of "write it only once." The development of the "mark sense" card opens up great possibilities, but this type of operation is not discussed in this paper.

The researcher in turning to the use of IBM machines quite naturally does not feel that this action has any special bearing on the schedules for recording data and information. A continued use of the general or orthodox schedule, however, is an open confession of a failure to give serious thought to fullest and best usages. The difficulties of card punching from

the usual type of schedule brought about the adoption of what may be called the master schedule especially designed to facilitate card punching. In the very nature of the situation, the master schedule suggests a completed job in preparation for key-punching. That is, all codes and computations are made by hand and written into the master schedule. By the same token the master schedule suggests the full multiple-item card. A continued use of the master schedule seems to sanction the retention of a considerable amount of hand work. It also means that card punching is viewed as primarily a manual operation, and that the main function of IBM machines is to process the punched card.

For a number of years, the master schedule was a major feature of IBM usage in the Texas Agricultural Experiment Station. In the latter part of 1949 field schedules were designed for a state-wide study of Texas agricultural cooperatives. Strangely enough, it was in the process of reshaping these schedules to make easier a transfer of data and information to master schedules that the idea sprang forth of shaping each page of the schedule for a punch card. At this juncture the master schedule faded into oblivion.

The possibilities of specially prepared schedules as the means for shortening the time required from the taking of the field schedule to the completed analysis are most intriguing. In several Texas studies checking and editing of schedules have been almost entirely eliminated. That is, one-item and check-item cards have been cut directly from the field schedules as received from the schedule takers.

Coding

Coding is the essential key to the identification of what is cut in the punch card. The statistical laboratory serving many researchers in the various departments needs codes to identify specifically each job or project processed. The researcher needs a code to identify the cards whether in a single deck or in series decks. In single decks, data and sort codes are identified by fields, or position, in the card. In multiple-item card decks, position must be tied to the code of each card in the series.

Codes may be single purpose or multiple purpose. As a general principle codes should be single purpose. Multiple-purpose codes tend to complicate sorting and tabulations. Social scientists as beginners in the use of IBM are prone to derive all codes by hand. Most codes, however, can be developed through the use of IBM equipment at a great saving in time and with a degree of accuracy not easily attainable in hand coding.

The Punch Card

In designing the punch cards one comes face to face with most of the problems involved in efficient usage of IBM equipment. Improvements in

the key punch has materially shifted the nature of card punching. Originally all punching was manual; gang-punching was restricted to one punch in one field at a time; no automatic reproduction of cards was possible. With the introduction of the electric key punch exact reproduction of the whole card became possible. With the introduction of the reproducing punch not only is exact reproduction possible but data and codes punched in given positions can be reproduced in other positions in the card. The reproducing punch completely changes procedures in the punching of original data and of codes. The important matter now is to get all the data punched in cards. For analytical purposes an almost unlimited number of manipulations are possible in rearranging data in cards to attain desired ends.

As a preliminary in the designing of a punch card, space requirements for identification and sort codes must be considered. The identification code required by the statistical laboratory of the Texas Agricultural Experiment Station covers 14 fields. Two more fields are needed in the Texas program to identify check-item and one-item cards and the individual cards in a series of multiple-item cards. One-item cards, in addition, must have fields reserved for item codes. Ample room must be left in the card for all the sort codes. After these requirements have been met, the remaining fields are available for data and coded information.

As for the check-item card, all the space left after basic requirements have been met can be used to good advantage for coded information. As for data, cards may be designed for several items to fill in all available space or for only a single item. With the multiple-item card the urge is strong to fill the card. There seems to be a feeling that somehow efficient usage calls for the full card. This is a mistake. The cost of cards is a very minor item in the total cost of operating IBM equipment. By the time the state-wide study of Texas agricultural cooperatives is completed, perhaps more than 100,000 punch cards will have been used. This number of cards costs less than the salary of a clerk for a month.

There is grave risk with a multiple-item card that not enough space is provided for necessary sort codes. A failure to get all pertinent codes in the card defeats, in part, the advantage of the punch card. The multiple-item card is very rigid as each position is exclusive. To provide "pockets" for all items that may appear may unduly increase the number of cards in the data decks. As the number of coded cards is increased, key-punching and tabulations become increasingly complex to handle. The other alternative is to edit and combine. This operation requires time and judgment. Most inexperienced clerks are not competent to edit. Such procedures destroy in large part the identity of the original data. Checking from punch card to original source becomes difficult and time consuming.

The one-item data card represents a significant departure from the

multiple-item card. With the one-item card position loses its meaning for purposes of identification as all data are cut in the same fields, or position. The identity of specific data is insured through the use of item codes. This type of card is specially well suited for recording original data as all items can be maintained in their lowest denomination. Such cards may, or may not, be fitted for use in final analysis. For instance, with one-item audit cards a considerable amount of combining is advantageous. The minimum of original and combined items is governed by the groupings required for the various ratio analyses to be made. This combining is a task that can be performed through summary punching. Furthermore if correlation analysis of costs be desired, all cost items of each firm can be assembled in a single card through the use of the reproducing punch.

From the standpoint of sorting and tabulations, one of the important advantages of the one-item cards is that data, information, and codes are assembled in one deck. Multiplicity of items is of no concern in the one-item program. No editing or combining of items is required in preparing the data for card punching. Stray or unanticipated items present no problem; all that is needed is space in the schedule for writing in of such items. The one-item card leaves ample room for adding such codes as may be required for analytical purposes. The ideal of "write it only once" is attainable. The relatively few fields involved in the one-item card make easy the task of punching and verifying of the cards. Both the wiring of the boards and the handling of the controls of the tabulator are much less complex than is the case with the multiple-item card. The one-item schedule is characterized by simplicity of design and greatly facilitates schedule taking either in the field or from primary sources.

Task of Card Punching

In the punching of cards the objective should be to reduce manual operations to a minimum through the fullest use practicable of gang-punching. The ideal to be sought may be expressed as "punch it manually only once and whenever possible multiple through gang-punching." Three types of material are usually punched into cards: (1) general information; (2) data and coded information; and (3) codes. In the case of the Texas study of agricultural cooperatives general information on an association consisted of such items as: identity number of the association; code number of the county in which located; the year of the data; and the year the association was organized. This general information must be punched manually, but only once for each association in a general information card. On an average each association had about 100 data items. After the punching of the data cards, the general information was gang-punched in all cards of each association. Thus the ratio between manual and gang-punching of general information was about 1 to 100.

All data and coded information must be punched manually. The arrangement of material in the schedule in such a manner as to simplify the punching job is very important. Taking into account such factors as make punching easy and convenient increases the speed of operations and insures greater accuracy. The researcher who uses the punch card also as the schedule for obtaining data and information to be punched in the same cards neglects completely to consider how this procedure makes key-punching a great hardship. The designer of such a card should be required to spend several hours punching his own cards.

In general, the more directly cards can be cut from the schedule the better. In cutting from a regular schedule hand coding is needed in most instances. Is there not a great loss in time and effort to fill in codes by hand which might as well have been written into the original schedule? Cutting multiple-item cards from a regular schedule is exceedingly difficult. A master schedule to which all data have been transferred is almost a necessity. This means recopying by hand. Not only does this type of operation depend largely on hand work but it also greatly increases the amount of manual key-punching.

The one-item card simplifies the task of card punching. The code identifying the item and the data to be punched in the card require only a small number of columns. The key-punch operator can pick up all the information at a glance and punch it as a unit rather than a column at a time. If an error is committed the punching of the corrected card is a very simple operation; little time is lost in consequence. In sharp contrast if all, or most of the 80 fields of a card are used in the multiple-item card, the key-puncher must be constantly alert and must exercise great care in order to get the information in the proper columns. If an error is made in punching, the card must be repunched. If the error appears toward the end of the card, the correction involves a considerable waste of time. The dulling monotony in punching all 80 columns decreases the speed and accuracy of the key-puncher. Operators who have punched both multiple-item and one-item cards are strongly in favor of the one-item.

Use of IBM Equipment in Deriving and Applying Codes

The adaptability and flexibility of IBM equipment in the development and application of codes are almost unbelievable. Most of the codes used for analytical purposes can be developed through the use of the IBM machines. In the Texas study of agricultural cooperatives each association was checked on 8 classifications as functions, kind of activities, products marketed, supplies handled, business connections, and the like. All the coding except for products marketed and supplies handled was done by hand. This hand process was slow and cumbersome. Much time had to be spent in checking for errors. In considering how best to handle marketing

and supply activities, a method of coding overlapping classifications was derived. As a consequence all 8 classifications were coded by use of the machines. The saving in time and the increase in accuracy were nothing short of astounding. This type of coding will be explained in a later paper.

Another concrete case can be cited to illustrate the use of IBM equipment in coding. In a study of farmers selling eggs on a graded basis, it was essential to maintain the identity of the producer making each delivery. Hand coding in assigning identity numbers to 500 producers makes a long list to be scanned to code each producer as his name appears on the sales slip. As farmers make 1 to 3 deliveries a week, the number of times the producers' code list must be used during the year runs exceedingly high. A much better way is to cut the name of the producer into the punch card of each delivery. After all cards have been cut for the year, a sort can be run on the names of the farmers. After this sort has been completed a numerical code can be added automatically, the first name in the list getting No. 1 and the last name a number depending on the number of producers.

Preparation of Tables and Sorting and Tabulation Operations

The final and all-important step in the planning of IBM procedures is that of designing table forms. In the first place, the tables serve as blueprints of the whole job of analyzing the data and information cut in the cards. In the second place, the tables indicate the necessary manipulations in organizing data in the cards to obtain desired results. In the third place, the tables test the adequacy of the coding. If any hand groupings are required, the coding should be amended to make all operations automatic in the machine runs.

The table forms serve as a complete guide to the kind and order of sorting. The nature and kind of controls are also indicated. Finally the table forms supply the pattern of the finished product of IBM processing.

Conclusions

A researcher considering the matter of turning from hand work to a use of punch-card equipment should be concerned with the question of how far machine operations may be substituted for hand work. In the main this involves three factors: (1) techniques to facilitate the transferring of data and coded information from schedules to punch cards; (2) methods of preparing and handling of coding in all its aspects and applications; and (3) procedures insuring the most direct and complete machine sorts and tabulations.

Fullest utilization of IBM equipment from the standpoint of the researcher depends upon the type of equipment available and the compe-

tence and expertness of the machine operator, together with his own comprehension of what the machine can do. The researcher and the machine operator must operate as a team in designing punch cards and schedules and in the planning of sorts and tabulations.

Anything expressible in figures or in code is suitable for punch-card manipulations. The number of data items in each category, the diversity of items, and the diversity of variables are important. IBM machines gain in usefulness as the data population increases and as diversity of items and variables broadens.

Best usage of IBM equipment starts with the schedule. The job of transferring data and information from the schedule to punch cards is greatly facilitated by the adoption of specially designed schedules. Cutting cards directly from entries in field schedules attains the objective of "write it only once."

Coding is the key to the identification of what is cut in the punch card. In the single-deck cards, codes, data, and coded information are identified by position in the card. In multiple-deck cards identification is a matter of position and the codes of specific cards. Codes may be single purpose or multiple purpose. In general single-purpose codes are better. Multiple-purpose codes complicate sorting and tabulating operations and do not normally allow enough flexibility.

In designing a punch card, space must be provided for: identifications needed by the statistical laboratory; identifications needed by the researcher; and all pertinent sorts needed in full analysis. After these requirements are met, the remaining space is available for data and coded information.

Best usage of IBM equipment is in no way dependent on a use of all 80 fields in the card. Cards are relatively inexpensive. The multiple-item card is very rigid in that each position provided for data is exclusive. As the diversity of items increases the number of decks increases. If positions for all items are not provided, editing and combining of items are necessary. This calls for judgment in editing and hand work in making additions. The operations of cutting of cards and of sorting and tabulating of multiple-item cards are complicated and cumbersome.

The one-item card represents a significant departure from the multiple-item card. Data are identified by item codes. Diversity of items raises no problems. This type of card is specially well suited for recording original data. If analytical purposes are better served by reducing the number of items, the combining can be accomplished through summary punching. The one-item card leaves ample room for pertinent codes. The ideal of "write it only once" is attainable in cutting cards directly from the field schedule. Card punching, sorting and tabulations are greatly simplified

with the one-item card in contrast with the multiple-item card. The one-item schedule is characterized by simplicity of design and greatly facilitates schedule taking either in the field or from primary sources.

In the punching of cards, manual operations should be reduced to a minimum through the fullest use practicable of gang-punching. Three types of material are usually punched into cards: (1) general information; (2) data and coded information; and (3) codes. Gang-punching is particularly adapted to general information and codes.

The arrangement of material in the schedule so as to simplify the job of punching is very essential. Taking into account such factors as make punching easy and convenient increases the speed of operation and insures greater accuracy.

The one-item card simplifies the task of card punching. The code identifying the item and the data to be punched in the card require only a small number of columns. The key-puncher can pick up all the information at a glance and punch it as a unit rather than a column at a time.

A surprising amount of coding can be done through the use of the IBM equipment. Machine coding is largely accomplished after all the data cards have been cut. Coding becomes a matter of once over for the whole job.

The designing of table forms is the final important step in full utilization of punch-card methods. The table forms are basic to the whole program of analysis. They test the adequacy of coding in the cards. Table forms serve as a complete guide to the nature and the order of sorting. Finally, the table forms supply the pattern of the finished product of IBM processing.

NOTES

MIGHELL ON METHODOLOGY

IN THIS rejoinder to Mighell's article, "What is the Place of the Equal-product Function?" in the February issue of this Journal, we want, first, to refute certain of his methodological ideas; second, to disagree with his logic concerning the practical problems of the majority of farmers; and finally, to comment on his criticism of the hypothesis and empirical data we used in deriving substitution rates in milk production. We lack space here to discuss most of the offshoots on methodology which Mighell injects through his many remotely related quotations and piquant phrases. Our interest lies more in those methodological propositions that are important in farm production research. We doubt whether the "old settler" is any more "permanent" in the profession than the younger members, or that he necessarily has a "larger perspective," and thus is charged with the "redrafting," "confirming," and "rejecting" all innovations in methods of research.

Methodological Issues

Contrary to Mighell's conception, a product contour is not looked upon as a new empirical procedure to supersede other approaches. Research workers acquainted with the product isoquant concept recognize that it is interwoven with other concepts. The product contour and the conventional input-output curve are parts of the interrelated production theory dealing with physical relationship such as factor-factor, factor-product, and product-product, none of which are unique or unrelated. If we are properly acquainted with the literature and with current research activity, we see no great stampede of persons attempting to use the iso-product concept in the vein of alchemy, as Mighell implies. Rather we believe that the formal work being done in this area is actually too meager; we hope it will be expanded in relation to many problems in agriculture in which it is useful.

Mighell, particularly as he discusses the bees, is apparently laboring under the impression that most people who are doing research in production economics believe that resources substitute at diminishing and continuous rates. Had he reviewed the literature more carefully, he would have found that a great deal of useful discussion of linear relationships has been published in the last several years.[1] Books on pure theory devote

[1] Much useful discussion of linear relationships has been published in the last several years and are not cited by Mighell. Important references here are Earl O.

more space to *curves* than to linear relationships or discrete points because (1) space is limited, and (2) the principle and logic that apply to continuous and diminishing substitution relationships, for any one who can make the adaptation, apply to linear *contours* or discrete opportunities; and (3) the logic that applies to linear or discrete substitution ratios is less complex. Therefore anyone who can apply the principle of *least cost* to a curved line can also apply it to a straight line or to discrete substitution opportunities. Theory books present a *general concept* in a curve; it is the responsibility of the individual applied worker to adapt the *curves*, that is, to specify the slope, curvature, or linearity. Most people who are even remotely acquainted with agriculture know that No. 1 corn substitutes for No. 2 corn at a constant rate in the rations of cows, hogs, sheep, and poultry, as is also true for protein from some sources and for different classes of feeds under specified conditions. Constant substitution rates exist also for hand picking of corn versus machine picking and for many other techniques on farms. Most people know these things and few suppose that if substitution is at diminishing rates for one particular pair of resources in an isolated instance, they are similar for the agricultural universe.

Cost analysis and "statistical correlation" (more accurately, regression analysis) have not been merely fads. Efforts in empirical analyses have had the effect of extending formal regression techniques. If we survey the field of agricultural economics, we find that regression analysis is very much more in use now than at any other point in time.[2] It is probably the appropriate technique for the greatest number of empirical problems in agricultural economics. Formal regression techniques permit some idea of the variability of the observations and provide a basis for objective statements as to whether a relationship exists in a probability sense. We agree with Mighell that for all practical purposes the feed-egg input-output coefficient may be constant. However, the appropriate statistical technique to test this hypothesis is not found in a free-hand regression

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Heady, *Economics of Production and Resource Use*, Prentice-Hall, 1952; T. Koopmans, Editor, *Activity Analysis of Production and Allocation*, Wiley, 1951; Robert Dorfman, *Application of Linear Programming to the Theory of the Firm*, University of California Press, 1951; T. Koopman, *Systems of Linear Production Function*, Rand Corporation, 1948; W. W. Leontief, *Structure of the American Economy*, Harvard University Press, 1941; Leon Walras, *Elements d' économie politique pure on the théorie de la richess sociale*, 2nd ed. Lausanne, 1889 (Equations de la production). Other treatments of the same phenomena under the heading of limitational factors, fixed coefficients, and similar terms can be found in Georgescu-Roegen, "Fixed Coefficients," Rev. of Econ. Studies, Vol. 8, pp. 40-49. Contrary to Mighell's notions, many other pieces of literature discuss discontinuous substitution and linear relationships.

[2] See particularly the efforts outlined in T. Koopmans, Editor, *Statistical Inference in Dynamic Economic Models*, Wiley, 1950 and G. Tintner, *Econometrics*, Wiley, 1952.

line as he implies in his comments on unique structural relationships, but in regression equations which permit comparison of a coefficient that allows diminishing returns with one that has a linear term only. Application of conventional tests of significance can then indicate whether to accept or reject alternative hypotheses.[3] We also reject the notion that cost analysis has been a fad and is no longer useful in economic analysis. Emphasis has changed, but agricultural economists are still estimating costs. Instead of seeking *the cost* they now recognize that cost per unit is a function of output, factor combination, etc., and get more useful results, such as those of Bressler,[4] Fellows,[5] Scoville,[6] and Nicholls,[7] to cite a few.

Aside from representing a parallel set of relationships in consumption, the indifference curves and utility surfaces discussed by Mighell have no direct bearing on production relationships and decisions. They make no particular contribution to empirical inferences in livestock feeding or other technical farm coefficients.

We know of no persons who "cling to the notion that a unique structural formula will be discovered to reveal the major mysteries of economics." On the other hand, we do believe that the major quantities that are of importance to agricultural economists are represented by structural relationships. Nearly all economic analysis concerned with resource substitution, input-output ratios, product-product relationships, productivity coefficients, and labor income in relation to quantity and proportions of resources involve functional relationships. Use of a least-square regression equation to estimate relationships no more supposes solution of a "mysterious structural formula" than do many of the other techniques commonly employed by agricultural economists. The structural relationship is present and implied if the empirical procedure is arithmetic and tabular analysis.[8] It is also present and implied even when subjective budgeting procedures are used in estimating a supply function.[9] The regression procedures are basically the same; only the estimating methods differ.

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[3] See G. F. Snedecor, *Statistical Methods*, Iowa State College Press, 1946, pp. 382-398 for examples of test for deviations from linear regression.

[4] R. G. Bressler, with W. F. Henry, and G. E. Frick, *Efficiency in Milk Marketing in Connecticut*, Conn. Agr. Expt. Sta. Bul. 259. (Also see Bressler and French, *Efficiency in Fruit Marketing*, Mimeo. report 128. Univ. of Calif.)

[5] I. F. Fellows, G. E. Frick, and S. B. Weeks, *Economies of Scale in Dairying*, Conn. Agr. Expt. Sta. Bul. 324.

[6] O. J. Scoville, *Relationship Between Size of Farm and Utilization of Equipment and Labor on Nebraska Corn-Livestock Farms*, U.S.D.A. Tech. Bul. 1037.

[7] W. H. Nicholls, *Labor Productivity Functions in Meat Packing*, University of Chicago Press, 1948. (See especially chapters 7 and 8.)

[8] As an example of this procedure for estimating "structural or mathematical relationships," see R. L. Mighell, and J. D. Black, *Interregional Competition in Agriculture*, Harvard University Press, 1951, page 187.

[9] As an example of this procedure in estimating functional, structural or mathematical relationships, see Mighell and Black, *ibid*, pp. 165-212.

Iso-Product in Application

Mighell implies that farmers are interested not in the least-cost method of producing a given output but in extending output along a factor-product line to equate marginal cost and marginal revenue because "the farmer has his eye more directly on the main chance." It seems to us that he makes two mistakes here, one dealing with the pure logic of maximizing returns and the other with the practical situation of the greater number of farmers.

Logic of Analysis. The input-output and iso-product relationships are not independent, nor is one more important than the other. How far output should be expanded depends upon the success with which the entrepreneur figures the minimum cost for a given output. Starting from a low output, the most profitable output is defined along the expansion path, a line showing the least-cost combination of resources for each output, until the most profitable level is reached (i.e. that at which marginal cost is equal to marginal revenue).[10] Unless output follows the expansion path of least cost, the level of output attained will not be the most profitable one; the level of output (the "main chance" of Mighell) depends as much on the slope of the family of product contours as on the slope of any one input-output *(scale)* line. Conceptually, Mighell's "knife edge" of maximum points is the same as our expansion path except that we define the maximum points along the path in terms of the slopes of the product contours and the factor prices, whereas Mighell appears to know their location intuitively. There are an infinite number of "roads" leading up over the production surface; no two of these lead to the same end in terms of maximum profits.

Practical Situation. Classical theory assumed that the entrepreneur was faced with perfect knowledge and unlimited capital. Therefore it was sufficient to suppose that the entrepreneur always chose the "main chance" and extended output to the line at which marginal cost equals marginal revenue. But recent literature is as much devoted to production under uncertainty where capital is limited and output is not extended to maximize profit. This is the practical situation of most farmers. Because of risk aversion or external capital rationing, few farmers that we know extend output to a level at which marginal cost equals marginal revenue. More of them use a limited quantity of capital and, therefore, have an output that is more nearly consistent with the amount of capital they can borrow, the quantity of funds they *feel safe about,* etc. Perhaps it is more nearly true for a farmer's total situation that he has a "job to be accomplished" and is concerned with the least cost method of doing this, than with attaining

[10] An elementary treatment of this point can be found in K. Boulding, *Economic Analysis,* Harper, 1947, pp. 690-696, or S. Carlson, *Pure Theory of Production,* King & Son, 1939, pp. 31-41.

the level of output which equates marginal cost with marginal revenue, as Mighell assumes. In our experience most farmers have, for example, 80 acres of corn and are concerned with the labor-machinery methods of producing the 4,000 bushels (if they use no fertilizer) or the 4,500 bushels (if they use some fertilizer) at the lowest cost. Also most of our farmer acquaintances produce, say, 15 litters of pigs or 12 cows, and are as concerned with the least-cost feed, building, labor and equipment set-up to accomplish these given quantities as with whether 15 or 30 litters or 12 or 24 cows will maximize returns. Ordinarily the output is limited by the available capital, and least-cost production techniques for a given output is highly important. Certainly the greater number of farmers are concerned with the ration that will minimize the cost of producing a 200, 225, or 250 pound hog. These are all problems of substitution and at the farm level, contrary to Mighell's postulates, they are just as important as decisions regarding the best scale for the farm as a whole or the best level of production per animal.

Dairy Substitution Rates

We agree with Mighell that the data used in deriving estimates of substitution rates in milk production have serious limitations. Had he reviewed the literature sufficiently he would have found that we had already discussed the points he presents; he simply restates our case. In review and with somewhat more precision, we have presented the dairy production surface in the alternatives of Figures 1 and 2. In the production surface of Figure 1, we suppose that the capacity of the cow's stomach gives a forage substitution limit such as *ad;* and therefore that the relevant production surface for decisions is more nearly of the form *madn* (Fig. 1) than the more general surface presented in text books. The same concepts can be presented in the manner of the contour map and

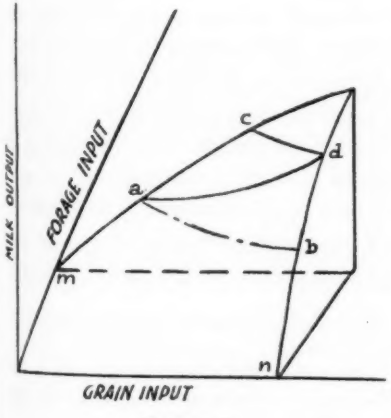

FIGURE 1

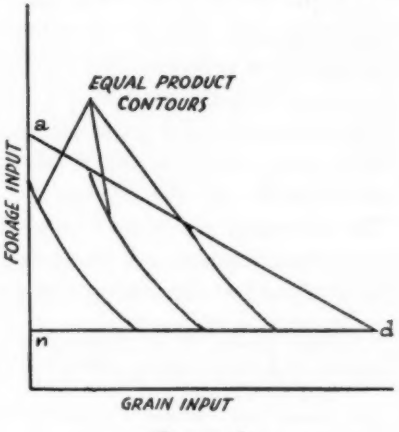

FIGURE 2

the limit lines *ad* and *nd* in Figure 2; *ad* represents the line of maximum forage, defining the cow's physiological well being. Substitution can take place along the contour lines only within these limits and some one single feed ration (point *d*) allows a maximum production per cow (the exact shape and slope of the limit lines are still to be established). In our previous analysis we attempted to find experimental data from which to estimate this surface. We used some of the data from the original Jensen-Woodward[11] study, not because it was well suited for this purpose but because it seemed to be the best available. We presented our estimates primarily as an example of methodology and with the following caution:

> It is possible that confounding of relationships has not been entirely removed. It is possible that the observations for each cow fall along the "stomach limit" line such as *ad* above. Because of differences in individual cows, the line *ad* may occupy different positions left to right on the production surface. If milk is then held at constant levels, the iso-product contours traced out, if all cows consume to stomach limits, may thus confound individual cow capacity with feed substitution.[12]

It is our belief that the original data from the Jensen-Woodward study have severe limitations for any type of analysis. First, the functions traced out in the original publication are not real input-output curves but are mongrels of iso-product contours, input-output curves, and stomach limit lines such as *ad* in Figures 1 and 2 above. Second, the data are so heterogeneous, with cows of different qualities and capacities and feeds of different kinds (i.e. beet pulp, straw, pasture of different kinds, legume hay, non-legume hay and silage of different grain content aggregated together as feeds), that the functions originally derived probably have little application to any one class of cows or feeds. For our analysis we selected the data for only the heavy breeds and for cows fed comparable feeds. Inasmuch as each cow was given an opportunity to satisfy her appetite for feed, the observations obtained represent points on the individual *capacity* or *appetite* lines of the thirty cows selected for our study. Ideally, we should have preferred data for similar cows fed varying combinations of feed and with the feed intake of some of the cows limited below capacity. But estimation of a particular product contour does not require observations along that contour. It can be estimated as well from a scattering of observations distributed over the portion of the surface which includes it. The voluntary restraints of some of the cows provide us with observations at scattered points on many individual product contours. We may use these data for estimating the production surface, and, from it specific

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[11] Einar Jensen, T. E. Woodward et al., *Input-Output Relationships in Milk Production*, U.S.D.A. Tech. Bul. 815, 1942.

[12] Earl O. Heady and Russell O. Olson, *Substitution Relationships, Resource Requirements and Income Variability in the Utilization of Forage Crops*, Iowa Agr. Expt. Sta. Bul. 390, 1952, p. 930. (*See also* page 929.)

contours, if we assume that the technical rates at which the different cows would convert a feed to milk at any given level (at least within the limited portion of the production surface with which we are concerned) are substantially the same for all of the cows in our sample. However, as we have tried to point out, there may be some confounding of the substitution relationship and the stomach capacity line in our estimates. Even if the cows having different stomach capacities did convert feed to milk at different rates one can hardly say that there is *no* element of substitution in the relationships derived from the data.

We do not believe that the feed substitution ratios are the only or even the most important quantities in selecting the optimum ration. The labor involved for dairy cows, price ratios, and the amount of risk involved for longer feeding periods with meat animals may make a ration with more grain economically desirable, even though it does not result in the minimum cost of feeds. Feed substitution is only one element of the feeding problem. We have completed a rather lengthy empirical analysis which includes risks (i. e. income variability), income, and nonfeed costs for different forage rations. For dairy cows, we have shown that over time a high grain ration has generally been the most profitable one and has not involved a significantly greater relative variability of income.[13] This is in contrast to the proposition of many *conservation minded* persons in the Midwest who put forth testimonials "to show that milk, pork and animal products can be produced most profitably with grass alone." Our findings point in the oposite direction. We also state:[14]

> Three basic sets of relationships determine the forage utilization system which is most profitable for an individual farmer or economically most desirable from the standpoint of society. These relationships are: (1) the rate at which forage substitutes for other feeds in the livestock ration and the rate at which forage substitutes for grain in the crop rotation, (2) capital and labor requirements, and (3) risk and uncertainty.
>
> When labor costs are considered, however, the greater time required in weighing feeds may cause a given grain-forage ration to be unprofitable. Rather than weigh out both grain and forage, the farmer may still find it is least costly to feed his milk cows a specified amount of grain while they are left free choice of hay. The data on income which follows in a later section are based on the latter method of feeding. These considerations are important since the farmer is interested in minimum costs of producing milk, only as all costs are taken into account.

We are also inclined to disagree with Mighell as to his idea that feeding standards generally recognize the substitution problem. The mere fact that nutrition books include a procedure to convert all feeds to a common T.D.N. basis, a supposition of constant substitution rates regardless of

[13] Heady and Olson, *ibid* (see pages 898-931).
[14] Heady and Olson, *ibid* pp. 864 and 880.

proportions, is an indication that the concept is not fully recognized. Another bit of evidence is the fact that ration recommendations are most frequently in terms of "a fixed combination of feeds," an implication that this *one* ration is least cost and most profitable and that feeds do not substitute at all (or are all limitational in nature). However, we will leave this area for further comments by Dr. Redman.

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A FURTHER NOTE ON THE EQUAL-PRODUCT FUNCTION

MY ARTICLE on the "Place of the Equal-Product Function" had two purposes, one specific and one general.[1] The specific purpose was to point out that a valid iso-product curve for milk production per cow could not be derived from certain data developed for another objective because of the nature of the experimental design. The more general purpose was to make some appraisal of the usefulness of the iso-product concept and its related conceptual framework.

We have all been aware of the growing points of a significant new body of production economic theory. They have thrust themselves on professional attention on many recent occasions. But the close spacing of six different publications (three articles, two bulletins, one book) each containing the same faulty iso-product curve for milk production suggested that it would be worthwhile taking a long steady look at the iso-product concept and its context.[2] Such rapid multiple publication must surely set some new kind of record, even in these days, and the energy

[1] Ronald L. Mighell, *What is the Place of the Equal-Product Function?" This Journal,* February, 1953, pp. 29-43.

[2] (1) Earl O. Heady, *"A Production Function and Marginal Rates of Substitution in the Utilization of Feed Resources by Dairy Cows." This Journal,* November, 1951.

(2) Earl O. Heady and Russell O. Olson. *"Marginal Rates of Substitution and Uncertainty in the Utilization of Feed Resources with Particular Emphasis on Forage Crops."* Iowa State College *Journal of Science,* October, 1951.

(3) Earl O. Heady, *"Resource and Revenue Relationships in Agricultural Production Control Programs." The Review of Economics and Statistics,* August, 1951.

(4) Russell O. Olson and Earl O. Heady, *"Economic Use of Forages in Livestock Production on Corn Belt Farms."* USDA Circular No. 905, July, 1952.

(5) Earl O. Heady and Russell O. Olson, *"Substitution Relationships, Resource Requirements and Income Variability in the Utilization of Forage Crops."* Iowa Research Bulletin 390, September, 1952.

(6) Earl O. Heady, *"Economics of Agricultural Production and Resource Use."* Prentice-Hall, New York, 1952, pp. 142-143.

and resourcefulness of those responsible merit high praise. Men in a hurry may justifiably paint with a broad brush, but one may also ask for an occasional pause for integration and translation.

It now seems that both purposes of my article have been well served. In the first one, Heady and Olson go beyond my position in saying that "It is our belief that the original data from the Jensen-Woodward study have severe limitations for any type of analysis." This is too sweeping an indictment of data adequately designed for other purposes, but it leaves little basis for the empirical construction that had been projected. In the end, we thus reach the same conclusion, that the available data do not furnish a sufficient basis for tracing iso-product curves for milk output per cow. But it is worth noting that our reasons do not coincide. Heady and Olson advance an interpretation which emphasizes the heterogeneity of cows and feeds and maintains that the functions derived by Jensen-Woodward are not real input-output curves. The more basic reason to my mind is that the original experiment was set up to answer different questions, and its design cannot be expected to yield pertinent data for the construction of iso-product curves applicable to the individual cow.

The scatter of observations upon which Heady and Olson have relied in making use of the Jensen-Woodward data is a controlled scatter. It is forced by the design of the original experiment to follow a path which merely outlines a stomach capacity line.[3] It is suggested that "The voluntary restraints of some of the cows provide us with observations at scattered points on many individual product contours." No method has yet been devised for directly interviewing a cow to determine whether she may be voluntarily restricting her diet for temperamental reasons. But every effort was made in the conduct of the experiment to make sure that every cow had full and free choice of roughage. Consequently we *know* only one point on each contour and the possibility of voluntary restraint seems remote.

But the general purpose has greater significance. Here, too, material progress has been made. The area of agreement is considerable once we have passed the sentinels of straw and found the way through the fog of semantics. Unfortunately, agricultural economists, like those in other technical fields, are guilty of puzzling lapses into professional *lingua franca*. That some of my statements have been interpreted in totally unexpected ways must have been the result of my own faulty use of the lingo. For instance the thought that any particular regression existed between age and ideas was far from my mind when the analogy of the pioneer was briefly suggested. Pioneering is an honorable profession and to be called a pioneer is at least a minor compliment.

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[3] Ronald L. Mighell, *Loc. cit.* (See Fig. 1.)

Methodological Issues

How new is the iso-product concept? We all understand that this is just one aspect of a general conceptual framework which has ancient roots, but which has received fresh emphasis in recent years and a good deal of sharpening and redefinition. In this enlivening process, Heady and Olson have shared in a highly creditable fashion. As my article tried to suggest there are now really two reciprocal routes for approaching the theory of demand and the theory of supply.[4] Some of us who had our first formal exposure to economics some years ago followed the one route and are now learning the advantages of the other the hard way. Those who were exposed to formal training more recently have put their feet on the new road but might profitably make a pilgrimage along the earlier way. This is one case in which both routes will continue in heavy use. They will reinforce and strengthen one another.

My passing reference to each new analytical device generating "a fresh wave of enthusiasm and hope" was apparently too brief to be clear. Note that nowhere was there any use of the terms *fad, dropped out of usefulness,* or similar expressions. My philosophy is quite the contrary. These waves of interest are essential elements in the progressive development of the field. In fact it might be well to think of a theory of progress in economic theory in terms like those of Schumpeter for the economy at large. A theory of innovation involves a continuing though somewhat intermittent flow of ideas. As each innovation appears, the spotlight focuses on it for a time. Presently the new concept is assimilated and becomes part of the general professional working equipment.

My expressions *cost analysis, statistical correlation,* and *equal-product function* are shorthand phrases to suggest certain episodes in this process. Regression analysis in an aggregate sense is probably more widely used now than in the 1920's. But the form of statistical correlation in vogue twenty years ago fills a relatively smaller place now than then. In like fashion, the focus in cost analysis has shifted to other phases. These things have been assimilated and developed as Heady and Olson point out. They have been modified and adapted to the changing conditions of the times.

While we are about the business of defining regression analysis to include broadly all relationships between variables whether handled by complex mathematics or by simple tabular methods, let us also avoid another confusion. In a very general sense *regression* becomes equivalent to *function* and we might as well say that *functional* or *regression relationships* include all economic research.

Let us be clear too on another point. No superior scientific virtue resides

[4] Good route names are still to be invented, but the earlier way approached the production surface through the variable factor–fixed factor relationships, the later way stresses the variable inter-factor relationship.

in complex methods as opposed to simple methods by reason of their complexity. The proper method on any occasion is the one that serves most efficiently. Economists have a special professional obligation to observe this truism, since the very heart of economics is making the most efficient use of available resources. We should as a matter of course, handle our own working tools and resources so as to achieve least cost and highest profit combinations in our professional endeavors.

Iso-Product in Application

Up to this point there has been little lack of agreement, only a difficulty in communicating in the same language. But now we seem to part company on the twin matters of logic and practice. Concerning the logic, it is perhaps necessary for both parties to recognize the existence of alternative routes that reach the same destination. If there are two roads from A to B, is it illogical to choose either? If there is any false logic, it would consist in using the longer or more costly road. In the present issue, the preferred route may sometimes be one and sometimes the other. There is no single answer.

But if we must say which route carries the heavier traffic, then there must be traffic counts or conclusions drawn from more general observation of the various conditions that arise on these two highways. I think we shall find that farmers make a good deal more use of factor-product than of inter-factor relationships, especially in any frame of reference that envisages variable output as contrasted with fixed output. The frequently indivisible character of available units of fixed production resources compels the farmer in many situations to choose between alternatives involving variable inputs applied to fixed factors. The point may seem trivial, except for the enthusiasm that some advocates of the iso-product approach have developed for exclusive routing up *the expansion path.*

The point about capital rationing does not appear to be pertinent to the argument. No present-day production economist, no matter what his intellectual origins, assumes that we live in a perfect world, or that we pursue every adjustment with unlimited capital. Such premises would upset any practical computations. In fact limitations of capital make a difference in any method, but they would seem to interfere more with calculations from an iso-approach than with those based on variable factors applied to fixed factors. A very practical restriction on the use of the iso-product analysis is the existence of so many limitations not only of capital, but of inflexibilities within a firm made up of a number of interlocking enterprises. The iso-product approach probably more often works best in a single-enterprise business where such limits are reduced to the minimum.

Finally, we seem to fall short of full agreement about hens and bees.

These small creatures were not introduced facetiously, but with full realization that they represent significant examples of biological production. They serve to illustrate the range of practical situations that may arise. One may learn from a hen or a bee, too.

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PROFESSOR SCHULTZ DISCOVERS THE WEATHER

PROFESSOR SCHULTZ in his new book *The Economic Organization of Agriculture*[1] has done our profession a real service in bringing together in one chapter some useful measures of demand elasticity and in publishing for the first time some extremely valuable data on agricultural inputs, by categories and in total. But his preoccupation in this volume with the weather as a determinant of year to year variations in farm output comes as something of a surprise.

In Part II, Economic Instability and Agriculture, Schultz develops and relates in a loose formulation three principal themes: (1) total inputs in agriculture are extraordinarily stable in both the short and long-run; (2) gross farm production, *trend eliminated,* is relatively stable, although about four times as variable (averaging the year to year percentage variations) as total inputs; and (3) since year to year variations in farm output cannot be attributed to changes in total inputs, those output variations must be attributable to the weather. At first blush this analysis appears adequate, but further consideration leads to certain doubts concerning its usefulness. Schultz gives weather too large a role as a determinant of supply on one hand, and this mistake in casting leads his analysis astray on the other.

Now our conception of the degree of output variability, and the pattern of that variability, depend in large measure upon what comparison is being made. Where year to year variations in output are measured from a linear trend (increasing at a rate of one per cent per year) the long-run pattern of output expansion, of course, appears stable and the short-run variations about trend are readily attributable to the weather. But such a procedure ignores the empirical fact that aggregate output has not trended upward at a constant rate since 1910 and it obscures completely the pattern of output expansion, which takes the form of steps or alternating periods of expansion and slackening off. It matters little whether we consult the index of gross farm production employed by Schultz (which closely reflects weather variability by years) or the index of production for sale and farm-home consumption (which is less closely associated with

[1] T. W. Schultz, *The Economic Organization of Agriculture,* McGraw-Hill Book Co., New York, 1953.

year to year variation in the weather)—in either case we observe that aggregate output rises noticeably between 1910 and 1920; levels off and fluctuates randomly (due to the vagaries of weather) between 1921 and 1936; advances in a dramatic fashion between 1937 and 1944; levels off again, and depending on the index under review takes another upward hop in 1948 or 1949. Certainly these changes in the rate of aggregate output expansion must be given some role, other than that of a passive linear trend, as a determinant of supply.

It is also the case that farm technological advance,[2] which typically takes the form of the adoption of new practices involving increased capital inputs in new forms, has not been smooth and continuous since 1910. And since changes in the rate of output expansion are not to be explained in terms of variable inputs, except insofar as we concentrate on the key category, motor vehicles, machinery and equipment,[3] it is reasonable to turn to farm technological advance for an explanation of output expansion in agriculture. This means relating the dynamic variable, farm technological advance to these changing rates of output expansion to develop a useful, hence predictive, but not exclusive determinant of supply.

It is one thing to say that the weather must share the stage with that lumpy variable, farm technological advance; it is quite another thing to suggest that the analysis goes astray. In what sense does it go astray and for what reasons? It goes astray in the sense of missing the crux of the farm price problem; and it does so, I would say, because of a preoccupation with that unruly, but not too damaging variable, the weather. Now to the logical basis of this assertion.

What instability is Schultz talking about? The casual reader might be inclined to guess variable output arising out of variable weather. But this cannot be the case for Schultz in a final appraisal of his input-output data concludes chapter 13 as follows: "As a consequence, the production of agriculture is one of the most stable variables of major importance in the United States economy." His original and once stated hypothesis rings clear, "Both the demand and supply of farm products are quite inelastic in the short run and, therefore, any large shift in one or the other of the two schedules will result in a large rise or fall in price."[4] Clearly the analysis is concerned with price instability in agriculture. Further, some suggestions are made with respect to the timing and the extent of shifts in the aggregate demand for food. But our attention is then turned toward and focused on the weather and year to year changes in output growing out of that weather. Never again does the discussion, either implicitly or

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[2] For a precise definition, See Heady, "Basic Economic and Welfare Aspects of Farm Technological Advance," *This Journal*, May, 1949.

[3] *The Economic Organization of Agriculture*, Table 7-5, page 107, Column 5.

[4] *Ibid*, page 176.

explicitly, return to the self styled subject of Part II, namely price instability in agriculture. Thus we are forced in this Schultzian formulation to deduce that price instability, *hence the farm price problem,* grows out of short-run changes in aggregate output (weather induced) and an inelastic demand function (which may shift on occasion, but this shifting action is not incorporated into a systematic model).

Now I am impressed by the weather too (particularly Minnesota weather!). A poor growing season may break an individual farmer, cut a crop in half on the Plains or cause the index of gross production to fall as much as 5 points in one year. But we note that the relative importance of the variable, weather, diminishes as the unit of inquiry moves from the individual farm operation to the national aggregate. Thus I submit the following: farm prices would have broken sharply in 1921, fallen again in the period 1929-32, risen over the period 1932-37, broken once more in 1938, moved up again between 1939 and 1943, shot skyward between 1945 and 1948, slumped in 1949 and shot upward again in 1951, *even if weather had been average over the entire period and for all parts of the country.*[5] These wide and sharp swings in the farm price level, which we know to be the farm price problem, arose out of the interactions of severely inelastic supply and demand functions *where* the shifters of demand include changes in personal disposable income and changes in foreign requirements and the supply function is sometimes quiescent and at other times pushed to the right through the force of technological advance. In one situation (say 1921) we have farm prices falling because of a contracting demand and a fixed supply, in another situation (say 1939-43) prices rising because an expanding demand is outracing an expanding supply, and in still another situation (say 1949) a slackened demand is overtaken by an expanding supply.

The broad outlines of this story are sketched by Schultz in *Agriculture in an Unstable Economy* (pp. 44-84), but those outlines are lost rather than developed in this latest effort. They are lost, I believe, because for some strange reason Schultz has chosen to concentrate on year to year irritations of the weather rather than the formulation of a systematic analysis wherein a meaningful concept of supply is related to the aggregate demand for farm products to yield a picture and an explanation of price instability in agriculture.

The hard facts are that Schultz in *The Economic Organization of Agriculture* fails (1) to use the fine input data which he presents and (2) to read the record of farm technological advance, to develop a rigorous,

[5] Interestingly enough weather seems to be cooperating with man in reducing price instability in agriculture. The price decline in 1921 and the low prices of the middle 1930's were moderated by poor growing seasons, and bumper crops were forthcoming over the period 1945-48.

operational concept of supply—a concept of supply arising out of the decisions of producers. Hence, no systematic analysis of price instability can emerge in this work. It is difficult, therefore, to view this work as an advance along the high road charted in *Agriculture in an Unstable Economy;* on the contrary, it would seem to turn down a blind alley.

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FARM VARIABILITY WITHIN BLOCK SAMPLES[1]

IN FARM management studies and in those of related fields, it is often desirable to minimize variation in some farm characteristics in order to facilitate analysis of relationships between other farm business characteristics. A type of sampling used in the past in hopes of selecting more homogeneous groups of farms, is the block sample. Block samples have been selected in some instances in the belief that contiguous farms would be more alike with respect to size and type of farming than those that were not contiguous. Soil composition, climate, topography, and accessibility to markets would seem to be most nearly similar for neighboring farms and would be expected to effect a similarity in size of farm and type of farming. Consequently, block samples might be expected to give greater homogeneity than the simple random sampling of a larger area. This note reports on an experiment that was carried out to make a comparison of the variability in block samples with that in simple random samples for a particular area in New York State.

Seneca County, New York, data were used in the experiment, these data being the most suitable of those at hand. Twenty roughly square areas were drawn within the county, each containing one hundred farms. The location of these blocks was decided upon by numbering all road intersections in the county, then selecting twenty of the intersections randomly. Using intersections as centers as nearly as possible, square areas were delineated within the county in such a way that each would contain one hundred full-time commercial farms. These twenty block-samples were used to check the assumption that a block-sample contains a group of farms that are similar in certain respects—more similar, for example, than could be obtained by simple random sampling from the whole of a county or larger universe. A comparison is made below between the average variability within twenty block samples, the variability within the universe from which these samples were taken, and the variability within simple random samples taken from the same universe. The comparisons are

[1] Part of the information for this note was taken from Quentin M. West, "The Results of Applying a Simple Random Sampling Process to Farm Management Data," Cornell University, Department of Agricultural Economics, A.E. 743, January, 1951.

limited principally to measures of farm or farm-business size, though certain aspects of type are implicit in the group of measures used.

The block-samples were found to be just about as variable, in regard to the four farm-business characteristics considered, as the universe from which they were drawn. The average of the sample standard deviations for the twenty block-samples are as follows:

Farm-business characteristic	Average block-sample standard deviation
Total acres operated	108
Acres in crops	66
Productive-man-work units	261
Number of cows	8

The universe standard deviations for these characteristics are as follows:

Farm-business characteristic	Universe standard deviation
Total acres operated	109
Acres in crops	68
Productive-man-work units	289
Number of cows	9

For total acres operated and for acres in crops, the average block-sample standard deviations and the universe standard deviations are almost the same. For productive-man-work units and for number of cows, the average block-sample standard deviations are somewhat less than those of the universe.

As a basis for comparing block sampling with simple random sampling, data were used from a previous experiment in which one hundred simple random samples of one hundred farms each were selected throughout the county. The standard deviations of these one hundred samples were averaged. For a more direct comparison, twenty of these one hundred samples were selected randomly (twenty block-samples were used), and the standard deviations of these twenty samples also were averaged. The average standard deviations within samples for the twenty simple random samples and for all one hundred simple random samples are shown below:[2]

Farm-business characteristic	Average standard deviation	
	Twenty random samples	One hundred random samples
Total acres operated	110	109
Acres in crops	68	67
Productive-man-work units	312	293

These figures when compared with those above indicate that there was very little difference between the block samples and random samples as to variability in total acres operated and acres in crops. For productive-

[2] For number of cows per farm, the standard deviations for the simple random samples were not available.

man-work units the block samples had, on the average, somewhat less variability.

On the whole, this short study indicates less homogeneity within blocks than many discussions of the subject suggest. The usefulness of blocks as observational designs for isolating relationships certainly is open to question in many instances.

Standard deviations found within block samples varied considerably from block to block. This is evident in the accompanying table. From the nature of the county, it might have been expected that blocks would have

STANDARD DEVIATIONS OF TWENTY BLOCK SAMPLES FOR FARM-BUSINESS CHARACTERISTICS, SENECA COUNTY, NEW YORK

Block	Farm-business characteristic			
	Total acres operated	Acres in crops	Productive-man-work units	Number of cows
1	102.91	63.29	391.15	7.66
2	116.70	71.94	237.26	7.35
3	110.95	66.96	404.23	7.31
4	118.49	74.94	238.21	7.17
5	117.39	74.56	227.64	6.09
6	117.73	74.74	228.52	7.22
7	106.91	60.74	200.22	7.47
8	135.57	94.13	233.60	6.71
9	133.53	94.97	239.31	6.61
10	135.50	94.99	239.62	6.78
11	138.56	93.79	290.50	9.47
12	99.07	61.20	224.19	9.06
13	119.21	58.50	241.50	9.34
14	88.43	55.68	279.11	10.36
15	87.37	42.52	233.43	8.80
16	85.77	44.99	256.65	8.43
17	85.12	49.72	257.62	7.40
18	85.46	50.37	266.50	8.14
19	86.90	49.01	265.25	8.01
20	89.39	51.47	281.50	7.70

been more homogeneous in some areas than in others. Actually, no geographic pattern appeared in this study. Highly heterogeneous blocks often were adjacent to much less variable blocks and located within the same physiographic areas.

Seneca County, of course, is more or less peculiar in its agricultural patterns, consequently no claim can be made that the results of this experiment can be generalized. The results as they stand do, however, underline need for observational designs more adequate than block samples.

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DETERMINING CONSUMER PREFERENCES BY PHOTOGRAPHS[1]

TWO problems are involved in the feasibility of any grading program: First, do consumer preferences indicate a desirability of sub-groupings of a commodity into grades with more uniform physical properties? Second, do consumer preferences agree with the number of grades established?[2] The purpose of this paper is to present a technique and analysis used in attempting to answer these questions. Eggs were used as the observational unit, although any commodity could have been used instead of eggs.

Preferences were related to established grades by obtaining observations of consumers on four United States standards of quality for individual eggs: AA, A, B, and C. Colored photographs of these grades were pasted on circular disks and randomly numbered. The photographs were of uncooked eggs as they would appear broken out of the shell. Regardless of how the disk was held, the position of any one photograph was not dominant.

Two surveys were made. The first survey included 503 respondents. In this survey a disk with photographs of the top view only was used. A second sample of 64 was randomly drawn from the original 503 respondents. Interviews were conducted six months after the original survey. Two disks were used: One with the top view of the four grades, and the other with the top view and profile of the respective grades.[3]

Tabulated Results of the First Survey

The following observations were obtained from the first survey of 503 respondents: (Table 1).

Note that grades AA and C were selected as first (i.e., best) by almost equal numbers. At the same time the most outstanding selected for second choice was grade A. Similarly, third choice was grade B and fourth was grade C. Grade C actually appears to have been selected as best or worst with few placing it in the middle. The results present further analytical

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[1] Journal Paper No. J-2194 of the Iowa Agricultural Experiment Station, Ames, Iowa, under North Central Region cooperative research project entitled *The Development and Analysis of Improved Techniques for Marketing Poultry Products.* Project No. 1029. More general results of this project may be found in the article "Habits, Preferences, and Demands of Des Moines Egg Consumers" by the above authors. *Poultry Science.* 30(No.3): 329–339. 1951.

[2] The important problem of whether or not consumers are willing to pay enough for their preferences to provide economic incentives for separation into various grades is apparent but is not included in this paper.

[3] On both surveys, respondents were told that numbers accompanying photographs were merely for identifying the eggs, that the eggs were all of the same size, and that color differences were only the result of photography. They were asked to rank eggs from the best to the poorest. Color rather than black and white photographs were considered necessary to establish rapport.

TABLE 1. RANKING OF EGGS BY 503 RESPONDENTS

Grade	Rank							
	First		Second		Third		Fourth	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
AA	189	39.1	108	22.8	74	15.7	101	21.3
A	87	18.0	228	48.2	118	25.0	41	8.6
B	20	4.1	118	24.9	251	53.2	86	18.1
C	187	38.7	19	4.0	29	6.1	247	52.0
Others[a]	20		30		31		28	
	503	99.9	503	99.9	503	100.0	503	100.0

[a] 25 respondents were not asked, gave no answer, did not know how to answer; 7 could distinguish no differences.

questions: Are there any significant differences within and among the rankings of Table I? If all the responses were analyzed simultaneously, would any significant ordering of preference occur? These questions are basic, but before discussing them, it might be of aid to qualify the data of Table 1.

Inconsistencies in Preferences for Grades

Having ranked the eggs according to their preferences, respondents were asked why they selected a particular egg as best. Their reasons for selection were not always consistent with what it had been intended the photographs would show. For example, respondents often selected a grade C egg as the best, but, in giving reasons for selection, described a grade AA egg.

An example of inconsistent reasons for selection is presented in Table 2. The grade C egg depicted on the chart had a flat yolk and thin white. Note that 15 per cent of the respondents described the yolk as upstanding. Had the enumerators attempted to correct inconsistencies in selection with reasons for selection, enumerator bias might have entered into the response. In addition, it was desirable to observe how satisfactory the

TABLE 2. REASONS WHY C EGG SELECTED AS BEST

Reason	Number	Per Cent
Just like it	16	8.6
Upstanding yolk, white, thick and firm, not spread out	28	15.0
Thin white, spreads out evenly, no second layer of white	32	17.1
Larger yolk	51	27.2
No chalazae or white stuff along side of yolk	6	3.2
Yolk centered	4	2.2
Larger yolk, no second layer of white	6	3.2
Miscellaneous	44	23.5
Don't know	6	
	187	100.0

photographs would be without enumerator "aid." Therefore, enumerators were instructed to report all responses without question.

Tabulated Results of the Second Survey

Because of inconsistencies in descriptions of the photographs, it was determined to observe the reliability of the top view chart responses in a sub-sample of the original 503 respondents.

The results of the sub-sample of 64 respondents for the two disks–top view photographs of the four grades, and top view with profiles of the respective grades–are presented in Table 3.

TABLE 3. RANKINGS IN SECOND SURVEY FOR TWO CHARTS

Grade	First		Second		Third		Fourth		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Grade Ranked (Top View Chart)										
AA	25	45.5	10	18.2	7	12.7	13	23.6	55	100.0
A	12	21.8	31	56.4	10	18.2	2	3.6	55	100.0
B	1	1.8	12	21.8	34	61.8	8	14.5	55	99.9
C	17	30.9	2	3.6	4	7.3	32	58.2	55	100.0
Total[a]	55	100.0	55	100.0	55	100.0	55	99.9		
Grade Ranked (Profile and Top View Chart)										
AA	26	45.6	16	28.1	9	15.8	6	10.5	57	100.0
A	20	35.1	29	50.9	6	10.5	2	3.5	57	100.0
B	1	1.8	10	17.5	39	68.4	7	12.3	57	100.0
C	10	17.5	2	3.5	3	5.3	42	73.7	57	100.0
Total[b]	57	100.0	57	100.0	57	100.0	57	100.0		

[a] Five selections involving ties between AA and A and three "no information" rankings are omitted. Observations on the second survey totaled 63 rather than the intended 64.
[b] Omitted are three ties and three "no information."

The rankings in the second survey are essentially similar to the first, although agreement as to ranking is more marked. For example, 39.1 per cent of the 503 respondents of the first survey placed AA first while 38.7 per cent placed C first. Tabulation of the selections made on the top view chart of the second survey shows the discrimination between AA and C to be keener than on the first; the profile chart shows an even more marked distinction. This is true throughout the rankings. When asked why they had preferred a particular grade in the second survey, reasons given by respondents also were more consistent for the top view with profile disk than for the top view disk alone.

The differences between the results of the two surveys require added explanation. Before it was decided to check the reasons for inconsistencies in responses, enumerators informed many respondents of the "correct"

ranking of the qualities after the interview was completed. This, in addition to added familiarity with the photographs in the second survey, appears to explain the differences in responses for the top view photographs in the two surveys.

Everything considered, it is believed that the only valid comparisons are between the two types of charts used at the same time on the second survey. In the second survey, 30.9 per cent selected C as the best egg in the top view chart while only 17.5 per cent selected the C egg as best in the chart which also showed the egg's profile. Similar increases in differences may be found in the other rankings in Table 3.

Rank Correlation Analysis of Preferences

Two questions now remain to be answered:

(1) Are the preferences indicated in Tables 1 and 3 statistically significant? Or, more concretely, if all the responses are analyzed simultaneously, would any significant ordering of preferences be indicated within and among the rankings?

(2) Are the preferences of the first survey of 503 respondents the same as those of respondents in the sub-sample?

To answer these questions, statistical analysis involving the rank correlation method was used.[4] A summary of the coefficients of concordance, "W's" (a measure of agreement), obtained by rank correlation analysis for the two studies and two types of charts is presented in Table 4.

TABLE 4. SUMMARY OF "W's" OBTAINED IN THE TWO SURVEYS

Charts	AA vs. A vs. B vs. C[a]	AA vs. A	A vs. B	B vs. C
		First Survey		
Top View	.0852**	.00758	.0922**	.175**
		Second Survey		
Top View	.120**	.000669	.146**	.146**
Profile	.326**	.00770	.224**	.468**

** Significant on the one per cent level.[b]

[a] In the rank correlation analysis values assigned for the four qualities were 1, 2, 3, 4. The value "1" is the most preferred; "4" is the least preferred. Preference totals for the survey of 503 respondents were 1,128 for AA; 990 for A; 1,176 for B; 1,416 for C. Preference totals for the top view chart in the sub-sample were 120 for AA, 116 for A, 145 for B, 169 for C. Preference totals for the profile chart were 109 for AA, 112 for A, 150 for B, 199 for C.

[b] "W's" may range from 0 to 1. That such low W's are significant in the first survey may be accounted for in the large number of observations.

[4] The method for this analysis may be found in Chapter VI of M. G. Kendall, *Rank Correlation Methods*. Charles Sniffin and Co., Ltd., London, 1948. pp. 80-89. More specifically, what is called "rank correlation analysis" in this paper, is the "case of 'm' rankings."

A most encouraging feature of the results is the consistency throughout. On both surveys and for both charts, W's are significant on the one per cent level for the same grades, and not significant for the comparison of AA versus A. As well, note that the W's increase in size (except for the one case of B versus C) not only between the first survey and the second, but also between the two types of charts used in the second survey. The increase in the coefficients for the top view charts in the two surveys is a likely result of enumerator-respondent relations mentioned above. But this difficulty does not enter into the analysis of the two different charts used on the second survey, and a comparison of the W's may be accepted with more confidence.

Whether or not the profile chart aids respondents is difficult to determine statistically. Responses to the profile chart were given after the top view chart had been used. The differences between the respective W's for the two charts are not independent. (A "z" transformation was used for testing independence between the W's.) Nevertheless, the increasing accuracy with which respondents described their selections when the profile chart was used, warrants the conclusion that the profiles were of some aid.

Conclusions on Interior Quality Preferences

From the results of Table 4 it can be concluded, on the one per cent level of significance, that consumer preferences do exist, grade AA (and/or A) being the most preferred, B the next preferred, and C preferred least of all.[5] Since there is not significant common agreement on AA being more preferred than A or vice versa, we may conclude on the one per cent level of significance that, of the four grades presented to consumers, only three physical grade standards exist in consumer's minds: A, B, and C.[6]

It is of interest to refer to Tables 1 and 3 and compare the rank correlation analysis with the results obtained when analyzing the tabular data. With reference to Table 1, an equal number of respondents chose AA and C as first. But if, having summed up the preferences of all rankings in Table 1 (which is what the rank correlation method does), it is

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[5] Fisher's "z" test was used. A more formal interpretation would state that since the probability of obtaining larger z values from a population in which no relationship existed was less than one per cent, the null hypothesis that there is no common agreement on interior quality preferences is rejected.

[6] Little more can be said than that a majority prefers A (or AA) over B over C. This does not mean that only A's should be produced. If some prefer A's over C's while others prefer C's over A's, then the two preferences should be catered to (for economic reasons). Preferences do exist on the consumer level; the extent producers and handlers respond to these preferences is another economic question. Of course, it is assumed that preferences are for actual eggs rather than for eggs in the photographs.

found that respondents did not prefer AA over A (or vice versa), then C obviously is ranked, at best, as second to AA (or A).

If the reader will refer to the second and third rankings of Table 1, he will note that a small number refer to C. Other than the large number preferring C as first, C is referred to in no other ranking by a large number of respondents, except as the least preferred grade. It is the peculiar quality of rank correlation analysis which permits the investigator to take into account not only the first choice of respondents, but the second, third, and fourth choices of all respondents simultaneously. This appears to explain the discrepancy between the rankings indicated by Table 1 and the rankings indicated by the rank correlation coefficients of Table 4.

Summary and Conclusion

It is apparent that the rank correlation method is more precise in ordering preferences of consumers than tabular analysis since all ranks are simultaneously considered.

It appears that three quality grades of eggs would be desirable under the conditions which existed in Des Moines at the time of the study. The study was not designed to determine whether the widths of the grades were correct. But the fact that AA was not preferred over A indicates the possibility of combining these two qualities.

Kansas State College A. S. GOLDMAN
Pennsylvania State College R. L. BAKER

A CRITERIA FOR PUBLIC LAND OWNERSHIP

PUBLIC land ownership is a problem of continuing interest and controversy. Much of the controversy that surrounds proposals for the substitution of public ownership for regulated or unregulated private ownership stems from a fundamental lack of agreement concerning the criteria for public ownership.

Some would have the government own only the land that no one else wants to own. Carried to the extreme this rather negative approach would probably leave the government without land for properly located essential public services. Government ownership of land through tax reversion is an example of private ownership showing a lack of desire or ability to hold land. Since a negative policy will probably not provide a sufficient amount of land for the programs of government, we must set forth some rules to determine the proper fields for public ownership and the amount of land that should be owned.

Ownership Fields

Some government operations requiring land ownership are entered into

to raise revenue i.e., the oil bearing tidelands. Here public ownership might be criticized because it interferes with the operation of our free enterprise system.

Resources often are required and used by the government in the course of carrying out some social policing action e.g., prisons and other regulatory agencies. Aside from the question of whether these programs are really what the people want, we can suggest that no more land than necessary be held for this purpose, and that the government always use the least valuable land appropriate for its needs.

Often land is acquired in order that the government may supply its own needs. The sites for the U.S. Government Printing Office, Bureau of Printing and Engraving, and the U.S. Mints are examples of this case. Here, the decision not to rely on private enterprise should be coupled with discretion in the choice of the sites to be used.

Some public ownership is dictated by public policy determinations in areas not within the private enterprise environment. Sites for public buildings, schools, highways, and military installations are illustrations of this situation. The public often does not directly consider land when these decisions are made. In these cases the extent of public ownership will be determined by the amount of, or the type of, land required to give society as much of the above service as it wants.

Land ownership is often approved because it is so closely associated with a desired end. For example, if the end is flood control, forest reserves, recreation sites, game preserves, hunting and fishing areas, and other such programs, a public land acquisition and ownership program may provide a logical means to carry out the program. Even here agreement is not complete, for many would argue that some of these programs do not require public land ownership, but rather can be achieved if the

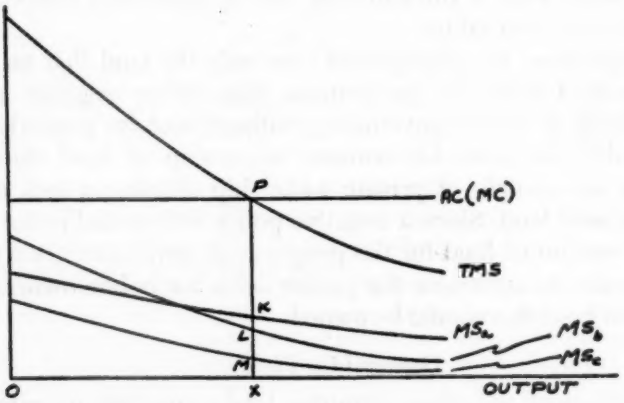

FIG. 1

government will supply incentives for or help in removing obstacles to private action.

Measuring Collective Choice

The foregoing discussion suggests that separate rules or criteria for judgment are needed when the question of public vs. private ownership of land is raised in connection with differing situations. These rules would have to take into consideration long and short-run public and private goals, alternative courses of action, and the particular land use. For example, general agreement exists that military installations should be publicly owned, but the factors that affect the area and the location of the land to be owned for this purpose are certainly different from

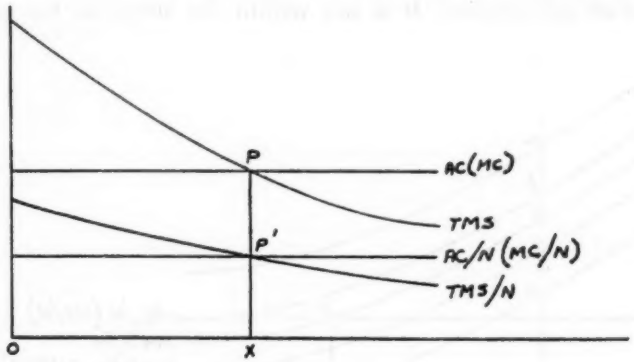

FIG. 2

those that determine how much land should be publicly held for education.

Important questions arise in connection with the determination of what and how much land the public wants to own, and of the uses to which it is to be put. How are we to determine the wishes of the public?

Our questions could be answered by placing alternatives before the voters on election day. This assumes that the complex issues could be simplified and that the voters could be educated and interested in the problem. With these assumptions in mind we have to set up a technique to use in the solution of our problem.

We are now concerned with a collective choice or decision rather than the market place determination of the individual. The vote of the individual should express his willingness to give up some individual goods (a cost to him) to obtain some jointly received benefit. The rate of substitution felt by each voter can be plotted and the decisions of all the voters can be summarized in an aggregate curve. The intersection of the substitution curve and a curve showing the cost of obtaining the land

should give the socially ideal amount of land ownership for the cost of the project and the benefit received would be equated.[1]

Thus the ideal level of operation to obtain the determined social goal for society as a whole would be the point at which the total of the individual marginal rates of substitution (TMS) is equal to the relevant (marginal or average) cost curve. The marginal rate of substitution in this case is a comparison betwen the social goal and other goods as it is felt by the individual expressed in money terms. (See Figure 1) The ideal level of operation also may be expressed as the point at which the average marginal rate of substitution per person (TMS/N) is equal to the relevant cost per person. (See Figure 2)

Obviously the method of apportioning the tax burden will affect the voters' rate of substitution. It is not within the scope of this paper to

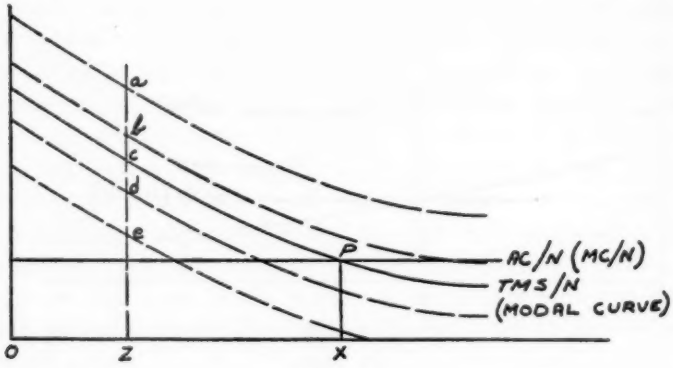

FIG. 3

set forth the proper apportionment of the tax burden. Also, the fact that the benefits of the land ownership may not reach each member of society equally will affect their voting.

Suppose that the individual's expression of the ideal output is expressed in his voting. We can assume that his voting for public ownership of recreational land, for example, will depend on the relative amounts of satisfaction that he expects to receive from different amounts of recreational land and the cost to him of these various amounts of land. We also must expect a wide range of individual MS curves and assume that their pattern will be such that a modal curve can be determined. (See Figure 3)

This system is not unlike our present system of handling increments to already existing supplies of public goods and services. For example,

[1] This analysis is adapted from Howard R. Bowen, *Toward Social Economy*, Rinehart & Co., 1948. Chapter 18, "Collective Choice."

people have some idea of the benefit to be received and the cost to be incurred when they vote to expand and develop our highway system. I assume that by this same technique society could decide between competing uses for a given area of land in much the same way the price system allocates resources between competing uses.

The difficulties in popular determination may make it desirable that we use the mechanics of our political party system to measure the wishes of the people. This is often unsatisfactory because insufficient alternatives are offered and because the voters may really be voting for personalities or other programs. Public opinion polls are another way of determining the public's wishes, but they have many of the same limitations as the ballot box technique.

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BOOK REVIEWS

The Story of Agricultural Economics in the United States, 1840-1932, Henry C. and Anne Dewees Taylor, Ames, Iowa: The Iowa State College Press, 1952. Pp. xv, 1121. $10.00.

This volume is the result of a happy but unusual combination of circumstances. Henry C. Taylor, himself one of the outstanding builders of Agricultural Economics, drew upon his intimate contact with persons and events over the past half century in the selection, evaluation and presentation of material. It is most fortunate that he had the interest, energy and time for this monumental task. Mrs. Taylor, a trained research worker, experienced in library study, gave invaluable assistance. Dr. Taylor, being a former Chief of the Bureau of Agricultural Economics, and Mrs. Taylor, a former staff member, were in a position to draw effectively on that agency. The Farm Foundation made it possible for the Taylors to devote several years to the gathering of materials and writing.

Work on this project began in the Bureau of Agricultural Economics in 1939 in response to a suggestion by Dr. Taylor who then was Managing Director of the Farm Foundation. Dr. Taylor retired from that position in 1945, "retirement" in this instance meaning release from other drains on his time and energy so that his attention and Mrs. Taylor's could be concentrated on completing the undertaking. Much of the time for the next several years was spent at the Library of Congress, which made over 3,000 books available for reference. More than 2,000 footnotes in the finished work, many of them referring to sources or citations, attest to the diligent use made of these resources.

Indications are that the goal originally may have been that of preparing a rather formal history. The designation "story" in the title finally adopted illustrates a shift to a less formal approach. The reviewer applauds this decision. A vigorous historical treatment would have necessitated constant weighing of approaches, views and emphases in order to obtain an exact balance. The developers of Agricultural Economics had varying backgrounds. Andrew Boss, George Warren and others had their roots and training in other agricultural disciplines. Henry Taylor came to the field with a strong preparation in general economics. The merging of these approaches into one was a gradual process. While Dr. Taylor cannot be accused of extolling his approach to the field over others, it is only natural for anyone to give special attention to developments in which he has had a direct part. In a formal history this might be subject to criticism. The designation of "story," however, allowed the authors more freedom without exposing them to a legitimate charge of bias on this score.

The title suggests coverage of the period from 1840 to 1932. The former apparently was selected because it marked the year of the first agricultural census, with crop estimating beginning about the same time. The terminus of 1932 is regarded as the end of an era. Most of the material is drawn from the latter half of this ninety-two year span.

It is difficult to indicate the scope of an encyclopedic work of this nature within brief compass. Perhaps the best way to do so is to list the headings of its eight parts. These are: Part One, "Economic Thinking Aroused by the Agricultural Depression of the 1890's"; Part Two, "Early Development of Agricultural Economics in Colleges of Agriculture"; Part Three, "Economic Analysis of Farm Management Problems"; Part Four, "Fact Gathering and Further Study of Farm Management and Agricultural Adjustments"; Part Five, "Marketing Farm Products"; Part Six, "Land Economics"; Part Seven, "Farm Labor and Farm Wages"; Part Eight, "Farm Finance" (by Norman Wall). These parts are made up of a total of thirty-five chapters. In short, here is material for everyone who has any interest in Agricultural Economics, be it specific or general.

Extensive use has been made of quotations from writings of workers in the field. The authors have woven these together into a connected whole. This method has brought individuals to life more effectively than if the story had been presented only in the words of the authors.

Few, if any, will endeavor to absorb the contents by concentrated attention in a brief period. A more general use will be that of turning to specific sections of special interest. Its organization and presentation adapt it well to such use. A comprehensive index adds to its usefulness as a reference. Students may accept its invitation to browse rather than to feel that they must take it chapter by chapter in order.

The size and cost of the book may deter many from adding it to their personal libraries. However, sight should not be lost of the wealth of information it provides and its permanent usefulness as a reference and refresher. Younger agricultural economists should find it especially helpful in gaining a better perspective of what has gone on before their time. Older workers will find in it many opportunities to renew contacts with a wide range of persons, personalities and events.

To the authors, the reviewer desires to express appreciation for their monumental achievement. You have rendered a real service of lasting value to Agricultural Economics.

O. B. JESNESS

University of Minnesota

Agricultural Policy of the United States, Harold G. Halcrow, New York: Prentice-Hall, Inc., 1953. Pp. xiv, 458. $5.50.

Here is another welcome addition to the growing literature in the field

of agricultural policy. Dr. Halcrow has done a careful, painstaking job and the book will be found useful as a text and reference.

The volume has 28 chapters. Eleven make up Part One, "The Agricultural Setting." Part Two, "The Objectives of Agricultural Policy," includes three chapters. The remaining fifteen provide the most extensive section, Part Three entitled "The Means: Policies and Programs."

The coverage of the field of Agricultural Policy is far from standardized and is likely to remain so in view of its range and ramifications, and the wide differences of opinion among persons interested in it. Under the circumstances, an author is entitled to wide latitude in his selection and treatment. This means, in turn, that others reserve the right to differ with his choice. For instance, one may wonder why considerable space is assigned to some phases while others are given only sketchy treatment. The author rightly emphasizes the role of limited elasticity of demand for farm products in instability of agricultural income. However, several chapters are devoted to supply, demand and elasticity with an array of illustrative curve diagrams. In view of the fact that Agricultural Policy is a subject not well suited to beginning students, it might be reasonable to assume that most students will have had some prior exposure to this background. The general reader probably can be reached more effectively by a briefer exposition of the fundamental ideas he should have.

Among features to which more attention might have been given is the comparatively small unit in agriculture. This characteristic is well known but the reasons for its prevalence and its bearing on farm problems and policies are less well understood. The small unit has important effects on production adjustments, on sources and methods of obtaining capital, on farm tenancy, and the like. This background is missed.

The author recognizes (page 165) that society establishes objectives of policy. In view of this, it might have been helpful if he had devoted more attention to the role of public opinion in policy making and execution. One unfortunate aspect of college life is the effectiveness with which many students succeed in insulating themselves from the outside world into which they expect to go after graduation. A young student needs to have impressed upon him constantly that he should give public opinion an important place in his thinking about public policy in any field. He needs to bear in mind that people are influenced by what they think the facts are even more than what they really are.

Some might have welcomed added stress on the importance to agriculture of high level stability in the economy generally. Everyone will not share the author's faith in government spending evidenced by his dictum (page 225) that the reason why deficit financing did not bring full recovery in the 1930's was that it was insufficient in amount. The effects of government expenditures during the war are not convincing evidence.

These expenditures were to meet governmental needs in waging war.

Dr. Halcrow brings out in connection with his discussion of instability and in the chapter devoted to fiscal-monetary policy the important relationships between the general economic situation and agricultural welfare. This is important because it helps impress the fact that the solution for many farm problems is found outside agriculture. This discussion seems to center largely on the extremes of inflation and deflation. More attention might have been given to reducing minor swings as well.

The author appears to have a predeliction for linking related subjects, e.g. forward prices and income payments; tenure and conservation, etc. While related, these have independent facets as well. Income payments need not be tied to forward prices. Many conservation problems arise outside tenancy. The vulnerability of forward prices to political pressures is not stressed. The knotty problem of deciding upon an appropriate division of responsibility between public and private interests for conservation is not covered in any detail. In view of the extensive confusion with respect to the place and nature of payments for agricultural conservation practices, a more incisive analysis of this activity would have been worth while. The reviewer would have liked to have seen more discussion of problems of production control. Attention to this phase is made doubly important by the tendency of proponents of 90 per cent supports to overlook control problems which such a program may create.

There are various points on which many readers will not see eye to eye with the author but that is true of any book in this field. Individuals having an interest in agricultural policy—and all agricultural economists should—will find this book of interest and usefulness.

O. B. JESNESS

University of Minnesota

Soil Conservation Districts in Action, W. Robert Parks, The Iowa State College Press, Ames, Iowa. 1952. P. 242.

The impending Republican examination of agricultural policy will surely probe activities in agricultural adjustment and soil conservation. Following the reorganization of February 1951 and subsequent personnel changes, a degree of integration has been accomplished in the SCS and ACP programs. The result has been, in part, improved technical guidance for the ACP program; in part it has been a new emphasis upon a more efficient—and more rewarding—farm production, to be secured with due attention to maintaining and improving soil resources. This new emphasis is in line with the Paley projection of a needed thirty-eight per cent increase in agricultural production by 1975—and with the USDA's more modest but still substantial estimates of future needs. But former SCS chief Bennett has denounced the "wreckers" of soil conservation in the

December, 1952, *Country Gentleman*. For different reasons, the integration has left the Farm Bureau and numerous, influential agricultural college spokesmen unsatisfied. Now that considerable changes are possible, what will be the objectives, content, and administrative arrangements of future programs in this area?

A significant aspect of this problem, the place of soil conservation districts, has been greatly illuminated by Professor Parks in his discussion of their origin, nature, role in achieving soil conservation, relationship to national programs, and possible future. The major worth of his study is its wealth of organized detail. No other source provides so much critical but constructive guidance for those anxious to improve the districts as means for achieving soil conservation.

The author correctly recognizes that:

"The policies which actually guide an administrative operation are generally the accumulation of small operational decisions. Only through experience with the day to day operation of the districts can supervisers gain the knowledge in conservation activity which will equip them for making policy decisions." (p. 53)

This is followed by close examination of the supervisers' activity in marking out the emphasis for district activity, in modifying the complete farm plan, in stressing minimum essential practices, in refusing to exercise coercion through the districts' land-use regulation powers, in establishing working priorities, in insisting upon balancing farm planning with applications, etc. The range of analysis is notable; it moves from consideration of district equipment policies, to an examination of procedures in supervisers' meetings, and to an examination of the democratic base of the districts (pp. 217-18).

The reviewer (in accordance with interpretations expressed elsewhere) prefers more stress than the author generally employs on other goals than technical conservation; nevertheless, Parks declares:

"The conservation program of the future, if it is to achieve its ends, must come to grips with the underlying institutional obstacles to conservation: land tenure arrangements, availability of credit, and so on." (p. 181).

When this statement is compared with p. 143, it appears that, even though the reliance upon the district as a means to achieving soil conservation and related ends may be considerable, it cannot be exclusive.

At the same time, Parks' book should be invaluable at the district, county, and farm level. But it will also prove highly useful at the state and national levels. For the author has analyzed with convincing detail the emergence (in some places, at least) of a degree of balance among national and state programs and the actual operations thereof through the medium of the district. He has shown that farmer supervisors have sometimes substantially modified national policies; yet he has argued that

public purposes have been served better by the presence of a national program. He concludes:

"Already the cross-fertilization of national and local experiences, which is taking place through the district mechanism, is resulting in a sounder and better proportioned approach to conservation activity than if either level of government were attempting to go it alone."

CHARLES M. HARDIN

The University of Chicago

Reporting Agriculture by William B. Ward, professor of agricultural journalism and head of the Department of Extension Teaching and Information, Cornell University. Comstock Publishing Associates, Cornell University Press, Ithaca, New York, 1952. Pp. xi, 362.

This book is self-described in its preface as ". . . a sort of primer that may be valuable to two kinds of persons: those who are anxious to enter one of the fields of agricultural journalism . . . and those who are beginners and want to progress faster. . . ."

Within its self-set limitations, the book is an excellent one. This book also should prove of value to the scientist who has had little or no training in agricultural journalism but who is called upon to report the results of his work to the public. Aside from giving a good insight into what goes on in getting agricultural information to the public, the book does have some "how-to-do-it" sections which should be helpful to anyone preparing information for public consumption.

The book is not—and apparently was not intended to be—a complete "handbook" for agricultural journalism. It should prove useful, however, to the economist (especially the Extension worker) who has had little formal education in journalism.

FRANCIS A. KUTISH

Iowa State College

Business Aspects of Commercial Poultry Farming, L. B. Darrah. New York: The Ronald Press Company, 1952. Pp. xv, 204. $4.00.

This is the second book on poultry economics to come from the Cornell campus within the last year. The two books contrast. The first[1] stressed facts as reported by surveys, the Census, and other sources, and offered few interpretations or recommendations; the current book is replete with interpretations and recommendations, but within the space of its brief 204 pages there was not room to include as much supporting data as might have been desirable. If one of them hadn't assured me otherwise, I would have believed that the writers had contrived so that interested readers should have to buy both books!

[1] Botsford, H. E. *The Economics of Poultry Management*, reviewed in *This Journal*, November, 1952, page 582.

Reviewers who read books in their specialized fields often complain about oversimplification. The plaint is applicable in this case. The oversimplifications will not disturb the nontechnical reader, nor will they mislead poultry practitioners whose areas of operation are in the Northeast, but the results might be more serious for students in parts of the United States other than the section from which Professor Darrah drew his source material. For example, ". . . to obtain the highest poultry meat prices, birds [taken from the laying flock] ought to be sold sometime between Thanksgiving Day and Easter." For farmers in Iowa, the State with the largest number of layers, this would not have been good advice in any year from 1940 through 1952.

Professor Darrah's willingness to be specific in stating conclusions and making recommendations is nevertheless one of the most desirable features of his book and one that will endear it to teachers, students, farmers, and prospective farmers in the Northeast. His advice to prospective poultrymen is especially sobering. The recital of the capital requirements for efficient full-time poultry operation is quite discouraging. The discussion of the salaried agricultural-service job in a rural area as a stepping stone to farm ownership is a worth-while addition to the usual mention of only the nearly-vanished hired man-tenant-owner agricultural ladder to farm ownership.

The book is strongest when its discussion is on management topics rather than issues concerning the nature of the demand for the products of the poultry industry. For example, after a discussion of the distribution of the consumer incomes in the United States, Darrah concludes that "the bulk of the real market, especially for poultry and high quality eggs, is in the higher income brackets." Poultrymen have obviously reached beyond the carriage trade in producing 400+ eggs and 35 pounds of poultry meat per consumer per year. And if "The consumption of eggs and chickens over the years has generally moved with the price level," that fact was coincidental: consumption of eggs and chickens moved with production. Eggs (and chickens) are so valuable that we eat virtually all that we produce, above requirements for hatching. Commercial international trade in them is negligible from a statistical viewpoint. Large-scale storage from year-to-year is impracticable. The reasons for the ups and downs in egg consumption must be sought in the motivations that encourage farmers to produce; fluctuations in demand affect the price paid for the eggs produced, and their per capita distribution among various income groups, but not the average per capita disappearance.

EDWARD KARPOFF*

Bureau of Agricultural Economics

* This review is not an official statement of the Bureau of Agricultural Economics.

LIST OF DOCTORAL THESES COMPLETED IN AGRICULTURAL ECONOMICS, 1952

Name and Institution	*Title*
John Cave Abbott University of California	Trends in Marketing of Poultry With Special Reference to Problems of Fryer Raisers in Northern California
Walton James Anderson University of Chicago	The Efficiency of British Columbian and Canadian Agriculture
Robert Carter Austin Harvard University	Marketing Problems in United States Cigarette Tobacco
William Burl Back Iowa State College	Firm-Household Interdependence on Low Income Farms With Particular Emphasis on Production Decisions, Capital Accumulation and Research Methodology
John D. Baker Purdue University	An Evaluation of the Accuracy of Federal Agricultural Economics Forecasts
Kermit Molyneaux Bird Pennsylvania State College	An Economic Analysis of the Frozen Food Locker Industry in Pennsylvania, Fiscal Year 1949
Charles Edwin Bishop University of Chicago	Under-Employment of Labor in Agriculture: Southeastern United States
H. Wayne Bitting University of Minnesota	Problems in Measuring and Analyzing Marketing Margins for Selected Fruits and Vegetables
Arnold Brekke University of Minnesota	Development of Agricultural Policy
Dorris Dudley Brown Harvard University	Problem Solving in a Farm-and-Home Teaching Program
George Kenneth Brinegar University of Chicago	Short Run-Income Expenditure Relationships
Wilbur Dahl Buddemeier University of Illinois	Some Economic Aspects of Crop Production
George Alvin Carpenter Cornell University	An Economic Analysis of Cooperative Bargaining Associations in the Processed Vegetable Industry

Name and Institution	*Title*
Emery Neal Castle Iowa State College	Adaptation of the Farm Firm in Western Kansas to Conditions of Uncertainty
Walter Eugene Chryst Iowa State College	Adjusting Farm Rents to Changes in Prices, Costs and Production
James Francis Coogan Harvard University	Sales Taxes in the Soviet Union
Rex Felton Daly University of Illinois	Some Considerations in Appraising the Long-Run Prospects for Agriculture
William Darcovich Iowa State College	Application of Expectation Models to Livestock Products
Bennett Avery Dominick, Jr. Cornell University	Merchandising McIntosh Apples Under Controlled Conditions—Customer Reaction and Effect on Sales
George T. Dowdy Ohio State University	An Economic Analysis of Consumer Food Buying Habits of Negro Families in Columbus, Ohio
Louis S. Drake Michigan State College	Problems and Results in the Use of Farm Account Records to Derive Cobb-Douglas Value Productivity Functions
Alexander Eckstein University of California	The Economic Development of Hungary, 1920 to 1950; A Study in the Growth of an Economically Underdeveloped Area
Carlos Clifton Erwin University of Illinois	An Economic Study of the Dairy Industry of Missouri
Abdel Hamid Fauzy-El-Attar Iowa State College	Yield and Price Expectations for Primary Agricultural Production
Irving Fellows Iowa State College	Returns to Scale in Potato Farming
William James Foreman University of Illinois	Farm Dwellings in Illinois—Some Economic Aspects
Burton Leroy French Iowa State College	Estimation by Simultaneous Equations of Resource Productivities from Time Series and Cross Sectional Farm Observations

Name and Institution	*Title*
Ray A. Goldberg University of Minnesota	The Competitive Position of the Minnesota Soybean Producer and Processor
Roger W. Gray University of Minnesota	An Economic Analysis of the Impact of the Price Support Program Upon the Development of the Potato Industry in the United States
Paul Eugene Grayson Cornell University	The Sampling Significance of Physical Variability Among New York Farms
Gustave Robinson Gregory University of California	Developing Economic Growth Goals for Forest Production
James Burton Hassler University of California	Pricing Efficiency in the Manufactured Dairy Products Industry
Dale Ernest Hathaway Harvard University	Farmers' Knowledge, Attitudes, and Agricultural Policy
Peter Louis Henderson Cornell University	Influence of Selected Marketing Services on Apple Sales
William Albert Hendrix University of Wisconsin	Achievement of Farm Ownership by Tenants and Sharecroppers in the Piedmont in Georgia
Walter Berkeley Hinkle, Jr. Cornell University	Merchandising Fresh Fruits and Vegetables in Retail Food Stores, Syracuse, New York, 1949-50
Geoffrey Arthur Hiscocks University of Illinois	Some Economic Assumptions about Human Behavior With Special Reference to Motivations and Farm Management
Roy E. Huffman University of Wisconsin	Economic Irrigation Development and Public Water Policy
Robert Forest Hutton Harvard University	The Country Bank as a Source of Agricultural Credit
Frank George Jarrett Iowa State College	An Econometric Analysis of the Demand for Livestock and Livestock Products
George Garrett Judge Iowa State College	An Econometric Analysis of the Demand for Eggs

Name and Institution	*Title*
Arthur Henry Kantner Cornell University	Marketing Eggs in Retail Food Stores
Richard Chien-Wen Kao University of Illinois	Theory of Dynamic Planning of Farm Production
Ian F. Keith University of Minnesota	An Economic Analysis of the Integration of Crop and Livestock Production in Southern Minnesota
John A. Kincannon Texas A & M College	Economic Analysis of the Texas Swine Industry
Dale Alpheus Knight University of Chicago	A Study of Selected Agricultural Problematic Production Situations
Stanley Krause University of Minnesota	The Marketing and Pricing of Minnesota Creamery Butter
Robert Jules Charles Krueger Cornell University	Marketing Margin: A Study of the Difference Between Farm and Retail Prices, One Fruit and Eleven Vegetables, 1930-1950
Frank Bristol Lanham Iowa State College	Evaluation of Farm Buildings as a Factor in Agricultural Production
Donald Elmo Larimore Harvard University	Marketing Activities of the Agricultural Extension
Charles Kenneth Laurent Cornell University	An Analysis of Market Reporting on the New York City Live Poultry Market, 1949-50
Charles Lemelin Harvard University	Agricultural Development and Industrialization of Quebec
Clayton Libeau University of Wisconsin	Economic Indicators for the Field Seed Industry
Catherine C. Little Harvard University	Postwar Developments Affecting the World Sugar Market
Milton L. Manuel University of Minnesota	The Historical Development and Evaluation of the Farm Management Service Associations in the United States
Chester Oliver McCorkel, Jr. University of California	Economies of Scale on Cotton-Potato Farms in the Shafter-Wasco-Delano-McFarland Area of California

Name and Institution	*Title*
Andrew Jackson Nichols Harvard University	Organizational Problems of the State Extension Service
Thaddeus Joseph Obal University of Illinois	Integrating National Agricultural and Fiscal-Monetary Policies
Howard Warren Ottosen Iowa State College	Economics of Forage Production and Utilization in Dakota and Dixon Counties, Nebraska
Emil W. Owens Ohio State University	A Study of Consumer Acceptance of Prepackaged Produce and Meats
Everett Eggers Peterson University of Chicago	Administered Pricing of Fluid Milk
Richard Phillips Iowa State College	Economic Nature of the Cooperative Association
Antonio Jose Posada University of Wisconsin	Economics of Colombian Agriculture
Barbara Benton Reagan Harvard University	Levels of Consumption of Regular Hired Farm Workers, 1940-50
Ben Reifel Harvard University	A Relocation Program for 300 Indian Families on the Fort Berthold Reservation, North Dakota
Franklin Jacob Reiss University of Illinois	Individual Differences in Entrepreneurial and Managerial Ability Among Illinois Farm Operators
Kenneth Leon Robinson Harvard University	A Study of Fluid Milk Margins in Northeastern Markets
Robert William Rudd University of California	Feeder Pig Prices With Special Reference to Kentucky Livestock Auctions
Vernon Wesly Ruttan University of Chicago	Technological Progress in the Meat Packing Industry
Frederic O. Sargent University of Wisconsin	Land Tenure in the Agriculture of France
Robert W. Schoeff Purdue University	Economic Analysis of Forage Production, Harvesting, and Storage
Charles H. Seufferle Purdue University	Trends in Agricultural Production and Consumption
John Sharp Ohio State University	Elasticity of Demand for Selected Agricultural Products

Name and Institution	*Title*
John Buckner Sharp, Jr. Harvard University	Educational and Related Service Work in Farm Forestry
Ahmad Zaki Abd-Elhadi Sheira Cornell University	A Study of Agricultural Credit as Related to Land Reform with Possible Applications to Under-Developed Areas
James A. Shute University of Minnesota	A Comparison of Dairy Cattle Labor Requirements for Stall and Loose Housing Barns
Louis Murdock Smith, Jr. North Carolina State College	Marketing Margins for American Cheese
Robert Samuel Smith Cornell University	Intra-Family Farm Transfers in New York
Stephen Cory Smith University of Wisconsin	Farm Employment Opportunities
Frederick Doster Stocker Cornell University	Non-Property Taxes as Sources of Local Revenue
Carl H. Stoltenberg University of Minnesota	Progress in Rural Zoning in Northeastern Minnesota
John Tuttle Stone Harvard University	An Analysis of the County Agent's Job
Robert Prindle Story Cornell University	The Finance and Management of Vermont Dairy Farms
Stanley K. Suddarth Purdue University	Cost Minimization in Primary Transport of Forest Products
Joseph Gwyn Sutherland North Carolina State College	The Effects of Mechanization of Cotton Production on the Competitive Position of Cotton
Jack Conrad Thompson Cornell University	The Techniques of Methods Engineering Applied to Agricultural Work—Theory and Practice
William Neil Thompson University of Illinois	Systems of Farming Adapted to Highly-Productive Level Land in Illinois
Raymond Herman Tremblay Cornell University	Farm Management Adjustments in Cabot and Marshfield, Vermont, 1926-1950

Name and Institution	*Title*
William Clayton Welden Harvard University	Wartime Management of Dairy Foods
William Nolan Williamson Harvard University	Administrative and Supervisory Processes in County Extension Program Building
Willard F. Williams Purdue University	Short-Run Expectations: An Analysis of Price and Production Expectation and Plans of Southwestern Indiana Dairy Farms
Walter Joe Wills University of Illinois	Livestock Marketing Problems in Southern Illinois
Elmer Joseph Working Harvard University	Studies in the Measurement of Demand with Special Reference to the Demand for Meat
Montague Yudelman University of California	South African Native Reserve Policy with Special Emphasis on Considerations of Welfare

AMERICAN FARM ECONOMIC ASSOCIATION ANNUAL MEETING

The annual meeting of the American Farm Economic Association will be held jointly with the Western Farm Economic Association at Oregon State College, Corvallis, Oregon, August 18-20. The following general program is planned:

General Sessions

A critical survey of contemporary agricultural economics.

Applicability of recent developments in methodology to agricultural economics.

Effectiveness of free market prices in allocating resources within agriculture.

Theoretical framework for the economic analysis of government assistance to development of resources.

Public policy for resource development in the West.

Long range prospects for agriculture.

Section Meetings

Activity analysis.

Use of economic models in commodity analysis.

Program for improving crop and livestock estimates.

Price supports for agricultural products.

Round Tables

Current research in farm management.

Current research in land economics.

Current research in marketing.

Current research in price analysis.

Current research in consumer demand and preference.

Current developments in agricultural economics extension.

Agricultural economics teaching.

Foreign agricultural technical assistance program.

Special Events

Address by True D. Morse, Under-Secretary of Agriculture.

Student debate.

Salmon bake.

NEWS NOTES

Norris J. Anderson, Associate Professor of Agricultural Economics at the University of Nebraska, has resigned to accept appointment as State Tax Commissioner of Nebraska.

James C. Atherton has joined the staff of the Division of Land Economics, Bureau of Agricultural Economics. His headquarters are at Stillwater, Oklahoma.

Antoine Banna, who has been with the Office of Price Stabilization, has returned to the Fats and Oils Section of the Division of Statistical and Historical Research, Bureau of Agricultural Economics.

Ronald H. Bauman of Purdue University will teach a course in Agricultural Economics at the Garrett Biblical Institute at Northwestern University June 20 to July 25, 1953. This will be in the World Leadership School of the Garrett Biblical Institute.

G. E. Brandow, Professor of Agricultural Economics at Pennsylvania State College, has taken a year's leave of absence to work with the Mutual Security Agency as an advisor on agricultural price policy to the Turkish Government.

C. B. Brotherton, Assistant Professor of Agricultural Economics at Montana State College, returned to duty at the college on January 1 from service with the Army Air Forces in Korea.

Vernon Carstensen, Associate Professor of Agricultural Economics and History at the University of Wisconsin, has been selected as Editor of the journal of *Agricultural History*, filling the vacancy caused by the death of E. E. Edwards of the Bureau of Agricultural Economics. Although the editorial office has moved to Madison, the office of Secretary-Treasurer remains in Washington, D.C.

Ivan L. Corbridge resigned as Assistant Agricultural Economist at the State College of Washington to accept a position at Brigham Young University.

Paul C. Clayton, a graduate student in Agricultural Economics at Ohio State University, has accepted a position at the University of Nebraska as Extension Poultry Marketing Specialist.

M. E. (Gene) Cravens, Jr., has resigned his position at Michigan State College to accept an appointment as Associate Professor in the Department of Agricultural Economics, Ohio State University. He will work in the field of fruit and vegetable marketing.

Albert B. Davis has joined the Division of Farm Management and Costs, Bureau of Agricultural Economics. He is currently working on a cooperative project with the Farm Placement Service, United States Department of Labor.

Peter P. Dorner has been appointed Assistant Agricultural Economist and Instructor in the department at the University of Tennessee.

Austin A. Dowell, Professor of Agricultural Economics, is now Assistant Dean and Director of Resident Teaching at the University of Minnesota.

Donald Durost, a graduate of the University of Maine, has joined the Division of Farm Management and Costs, Bureau of Agricultural Economics.

C. M. Elkinton resigned as chairman of the Department of Agricultural Economics at the State College of Washington in October 1952, to become Deputy Administrator of the Mutual Security Administration in Western Europe. Dr. Elkinton's headquarters are in Paris, France. He is in charge of the Food and Agriculture Division of MSA.

H. E. Erdman, Professor Emeritus at the University of California, is joining the University of Illinois staff for the 1953 summer session. He will teach a course in agricultural cooperation.

C. C. Erwin, formerly Assistant Professor in the Department of Agricultural Economics at the University of Missouri, is now on the staff of the Department of Agricultural Economics at the University of Kentucky.

Winn Finner and Troy Mullins of the Bureau of Agricultural Economics have returned from the Virgin Islands where they were on loan to the Office of Experiment Stations. Their time there was spent primarily in surveying the agriculture of the islands and in making recommendations as to the lines of work to be carried on by the newly created Virgin Islands Experiment Station.

Emanuel R. Fuchs has been appointed staff economist to the United States Department of Interior's Missouri Basin Field Committee which coordinates the programs and activities of Interior agencies engaged in the Missouri Basin development program.

Karl Gertel has returned to the Division of Land Economics, Bureau of Agricultural Economics, following the completion of course work for his doctoral degree at Iowa State College. He is stationed at Lincoln, Nebraska.

Roger W. Gray, formerly Research Fellow, Department of Agricultural Economics, University of Minnesota, received his doctoral degree in December. He has been appointed Assistant Economist, Bank of America, San Francisco.

Clifford M. Hardin, Director of the Agricultural Experiment Station and former Head of the Department of Agricultural Economics, has been named Dean of Agriculture at Michigan State College, effective July 1, 1953.

A. H. Harrington, Associate Agricultural Economist, has been named Chairman of the Department of Agricultural Economics, Washington State College.

Marshall Harris, Division of Land Economics, Bureau of Agricultural Economics, has taken leave from his government assignment to serve for a few months as a subject matter consultant to the Iowa State College in the preparation of a series of TV programs dealing with world land tenure problems.

Burnell Held, who recently completed the requirements for his doctor's degree at Iowa State College, has been appointed Assistant Professor, Extension, Department of Agricultural Economics, Michigan State College.

Ray A. Higgins has resigned from his position at Michigan State College to join the staff of the Super Market Institute at Chicago.

William O. Jones, Associate Economist in the Food Research Institute of Stanford University, left in March for a four months' tour of equatorial Africa, where he will study indigenous agriculture and in particular the economics of the manioc root. He will visit the Belgian Congo and the French and British colonies of the Guinea Coast.

Leonard R. Kyle, who has been on the Purdue University staff and received his doctoral degree from that institution in January 1953, has joined the University of Illinois, Department of Agricultural Economics, as Assistant Professor in Farm Management Extension.

G. W. Kuhlman, Professor of Agricultural Economics at Oregon State College, passed away on December 13 following a rather short illness. Kuhlman, a native of Wisconsin and a Ph.D. from the University of Illinois, had just completed 25 years of service in Agricultural Economics at Oregon State College prior to his death.

David E. Lindstrom, Professor of Rural Sociology, University of Illinois, has

taken a leave of absence to join the International Christian University in Japan for a three-year period.

J. Wendell McKinsey was promoted to Associate Professor upon his return January 1 to the staff of the Department of Agricultural Economics of the University of Missouri after a 15 months' leave of absence, during which time he was studying for a doctorate at the University of Chicago.

Paul Mohn, who received his M.S. degree in Agricultural Economics at Mississippi State College in January, has joined the staff at Oregon State College as a full-time Research Assistant. Next fall he plans to begin work on a graduate program leading to a doctorate in Agricultural Marketing.

R. J. Mutti, University of Illinois, is on a sabbatical leave of absence for the second semester of the 1952-53 academic year. He will be studying agricultural marketing problems with headquarters at the University of California at Berkeley.

John A. Nordin has been promoted to a full professorship on the staff at Iowa State College.

Thaddeus J. Obal has resigned as Associate Economist of the Congressional Joint Committee on the Economic Report to accept a position as Economic Analyst with the Economic Analysis Department of the Ford Motor Company, Dearborn, Michigan.

Howard Osborn, who recently returned from a year's study at Oxford University under an Elmhirst Fellowship, accepted a position on January 1 with the Oregon State College Extension Service. Osborn will be working in Portland, Oregon on a project in cooperation with the Bureau of Agricultural Economics, Division of Agricultural Estimates. The project involves the assembly and analysis of basic data on seed crop production, prices, and income in Oregon.

Don Paarlberg is on leave of absence from Purdue University to serve as Economic Advisor to Secretary of Agriculture Benson in Washington.

Roy Potas is now with the Livestock Division of Agricultural Estimates, Bureau of Agricultural Economics. He was formerly with the State Statisticians' offices in Minnesota and South Dakota.

Philip M. Raup, Department of Agricultural Economics, University of Wisconsin, has been appointed Professor of Agricultural Economics, University of Minnesota, effective July 1.

Mont S. Saunderson, formerly Agricultural Economist at the Montana Agricultural Experiment Station and more recently Economist for the U. S. Forest Service stationed in Denver, Colorado, has retired from the forest service and established a private ranch management consulting service in Bozeman, Montana.

Willard E. Savage, Assistant Agricultural Economist of the Maine Agricultural Experiment Station, has resigned to accept a position with one of the large poultry dressing plants in the State.

Sol Sinclair received his doctoral degree from the University of Minnesota in March 1953 in the field of Agricultural Credit. He is a member of the Economics Department at the University of Manitoba and has recently been promoted to the rank of Professor of Agricultural Economics.

Vernon L. Sorenson, Research Fellow, University of Minnesota, will join the staff of the Department of Agricultural Economics, Michigan State College, as Assistant Professor in July.

John H. Southern has transferred to the Technical Cooperation Administra-

tion from the Division of Land Economics, Bureau of Agricultural Economics, at State College, Texas. He will be stationed at Karachi, Pakistan.

Harry A. Steele has returned to the Division of Land Economics, Bureau of Agricultural Economics, from an assignment with the Missouri Basin Survey Commission. He served as Assistant Executive Director from May 1952 until the completion of the Commission's report in February 1953.

H. A. Swedlund, in charge, Washington State Office of Agricultural Estimates, Bureau of Agricultural Economics, died suddenly of a heart attack on February 17.

Ralph Tompkin has resigned his position as Assistant Professor of Agricultural Economics at South Dakota State College, effective April 1. He is taking over the operation of a farm business in Iowa.

Keith R. Vice came from Kentucky on January 19 to join the Division of Farm Management and Costs, Bureau of Agricultural Economics.

S. T. Warrington joined the staff of the Division of Agricultural Economics, U. S. Extension Service, the first of the year. He is in charge of the livestock, dairy, and poultry marketing section.

T. J. Whatley, Associate Agricultural Economist at the University of Tennessee, received his doctor's degree from Purdue University January 1953.

CLAUDE O. BRANNEN
1884-1953

Claude O. Brannen, Marketing Specialist at the USDA and University of Arkansas faculty member for 23 years, died March 19, 1953 after a short illness. He was a member of the Editorial Council of the American Farm Economic Association from 1942 to 1948.

Born at Holly, Texas, he received his B.S. and M.S. degrees at George Peabody College, Nashville, Tenn., in 1918 and 1919. Columbia University awarded him his Ph.D. in 1929. He served from 1919 to 1925 in the Bureau of Agricultural Economics, and then went to the University of Arkansas to head the newly organized Department of Rural Economics and Sociology. He remained as head of the department, assistant and director of the Agricultural Experiment Stations, acting dean and director of the College of Agriculture and director of the Bureau of Research until 1948.

In October 1948 he returned to the USDA to assist in the Program of developing research and service work of the State Departments of Agriculture and Markets.

His major work was in information on land tenure, including many bulletins and scientific papers on the subject. He was also valuable as a committee member. Probably his most outstanding contribution was that an entire state became conscious of the economic and social needs of farm peoples.

J. A. B.
C. B. G.

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